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portance rendered. Lord G. Hamilton explained the profuseness of supply of officers for this branch of the service by laying stress upon the exceptional advantages in the way of education offered to engineering cadets at the Royal Dockyard. This is very true when the high premiums that engineering students have to pay to complete their professional education on land are considered.

The Russian Government made a happy move when they accepted and fostered the popular impulse to provide a volunteer fleet. It will be remembered that a sudden scare as to possible war set the various municipalities on fire to provide volunteer vessels at their own cost, such as would probably pay their way as transports or trading vessels in time of peace, but which would be especially built so as to be readily convertible into fast cruisers in time of war, and which, if equipped and armed in the open Pacific, might do enormous damage to the maritime commerce of an enemy before they could be caught or captured. To carry out this ideal the vessels were to have unsurpassed qualities in speed and coal capacity. These ideals appear to have been realised in the twin-screw steamer *Oriel*, just built and engined by Messrs. R. W. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, for the said Russian Volunteer Fleet, and which left the Tyne for Odessa on the 11th ult. Her official trial took place on the 5th, under the supervision of Captain elenoi, naval attaché to the Russian Embassy in London; Colonel Vachtine, Director of the Russian Volunteer Fleet; and Captain Kasey, the commander of the vessel. The *Oriel* seems to be an exceptionally well-built vessel, and to have even surpassed all records of the American liners in speed and endurance. On the trial the vessel was in complete cruising condition, with all her weights and stores on board, and 2,000 tons of cargo. She was put on the measured course of 9·6 knots off the Tyne, under natural draught, and a main average speed with and against the tide of 19·37 knots was realised for the two runs. The average revolutions were 97·7 per minute, and the average I.H.P. was 9,934. The *Oriel* then proceeded to run out to sea for six consecutive hours, and during that period made an average of 96·4 revolutions per minute, and a corresponding speed of 19·11 knots per hour, and 9,098 I.H.P. This, to be obtained by a vessel 452ft. over all, by 48ft. beam, with twin-screw vertical engines of 34in., 54in. and 35in. cylinders by 51 in. stroke, with natural draught only, is, we believe, a somewhat noteworthy result. The boilers are four in number, double-ended, 15 ft. in diameter by 18 ft. long, having 17,204 sq. ft. of heating surface, and 615 sq. ft. of grate area. This gives at sea 14·76 H.P. per sq. ft. of grate area, and the square feet area of heating surface 1·73 per I.H.P. during the whole continued period of six hours under natural draught. Naturally, the Russians are delighted with their acquisition, and we can but be disappointed that so fine a vessel is going out of the country.

NOTES ON RECENT NAVAL MANŒUVRES.*

By W. H. White, F.R.S., Assistant Controller of the Navy, and Director of Naval Construction, Vice-President.

The Council of the Institution, finding themselves less favourably placed than in former years in relation to papers offered for reading and discussion, urgently requested me to contribute to the programme of the present meetings. Under existing circumstances, as will be readily understood, compliance with this request was for me no easy task, especially as the notice has been so short. Moreover, after the very large amount of time given last year to the discussion of my paper "On the New Battle Ships," I should have preferred leaving to other members the opportunity of giving direction to our discussions.

Yielding to representations that the interests of the Institution would be best served by compliance with the request of the Council, my difficulty was to select a subject of general interest, which could be treated with some approach to completeness in the very limited time available. Finally, I decided to place before the Institution these "Notes on Recent Naval Manœuvres," dealing with some important matters which have already been made the subject of discussion and criticism in the public press or elsewhere, and respecting which there seems room for further explanation or illustration. My chief aim in writing this paper has been to deal chiefly with facts, and to provoke discussion.

Members of this Institution are aware that, at the request of the First Lord of the Admiralty, I went afloat last August, and remained with the Fleet during the Manœuvres. Excellent opportunities were thus afforded me for observing the operations of mimic warfare and fleet manœuvring; and we had the good fortune during a considerable part of the time to experience weather of exceptional severity for the season of the year, so that it was possible to make useful notes of the behaviour of ships of various types. My interest naturally centred in matters affecting or related to my professional work as the responsible designer of H.M. ships; and in what follows I shall endeavour to place before the Institution certain broad deductions which have impressed themselves on my mind, and certain opinions previously held, which have been deepened as the result of my brief cruise with the Fleet.

I.—The Influence of Size and Weight upon the Sea-going Qualities of Ships.

This matter was discussed at some length at our meetings last year, in connection with papers read by Sir N. Barnaby and myself. It also occupied a prominent position in the discussion following upon a paper read by Sir N. Barnaby before the Institution of Civil Engineers. It would appear, however, that there is room for further consideration of the question.

The point here raised is not the *absolute behaviour* at sea of ships of different sizes and weights, but their *relative behaviour*, under identical conditions of wind and sea. Consequently, a judgment can only be formed by comparing the behaviour of ships of different sizes navigating together. And the comparison is made most valuable when a fleet includes vessels of widely divergent dimensions, with the gradations of size, from the smallest to the largest represented, at fairly close intervals. Probably the Manœuvres of 1889 fulfilled these conditions better than any previous assemblage of ships. Beginning with the *Inflexible*, of nearly 12,000 tons, by successive steps one could pass down to the torpedo gunboats of about 500 tons, and torpedo boats of less than 100 tons. Table A shows this at a glance.

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* Read at the Thirty-first Session of the Institute of Naval Architects, March 26th. Earl of Ravensworth, President, in the chair.

While recognising the comparatively limited scope of the observations possible during the Manœuvres, it is undoubted that everyone who saw these ships under circumstances of bad weather, must have been impressed with the superior behaviour and fighting qualities possessed by the larger vessels as compared with the smaller, when other features—such as freeboard and height of guns above water—were similar in the ships of differing sizes. Reference will be made hereafter to the influence of freeboard and disposition of armament on fighting efficiency. But dealing simply with weight and length, as elements influencing the behaviour and the maintenance of speed at sea, it may unhesitatingly be asserted that increase in size has a most marked effect in improving sea-going qualities.

This may seem a mere truism, but there is a special reason for dwelling upon it. There is a general agreement that, up to certain limits, increase in size results in considerable advantages. But it has been maintained by some authorities that, beyond a certain limit of size, and that not very considerable, these advantages become relatively less important. For instance, Sir Nathaniel Barnaby last year made the following remarks (at the Institution of Civil Engineers), when advocating the construction of vessels of 3,000 to 3,500 tons displacement for service on the line of battle:

"It is said that the ship of 3,000 tons was very small. His object in advising those who prepared the design was to keep to a ship of minimum size for doing the work. That a ship could be made larger with advantage was no doubt true; but he thought the ship in question fairly balanced all the qualities that could be got in a ship of the smallest size, capable of fighting an action at sea. . . . He agreed with those naval officers who thought that any weather which would sensibly affect the comparative behaviour of the ship of 3,200 tons and that of 14,000 tons, would be found to be not fighting weather for either ship."

TABLE A.

List of Vessels engaged in the Naval Manœuvres of 1889, arranged in Order of Displacement.

Ship.	Displacement.	Length	Ship.	Displacement.	Length
	Tons.	Feet.		Tons.	Feet.
Inflexible ..	11,880	320	Mersey Class	4,050	300
Northumberland	10,780	400	Hotspur ..	4,010	235
Admiral Class	10,600 to 9,500	325	Iris & Mercury	3,730	300
Devastation ..	9,330	285	Active & Volage	3,080	270
Neptune ..	9,310	300	Medea Class	2,950 to 2,800	265
Black Prince	9,210	380	Calypso ..	2,770	235
Hercules ..	8,680	325	Ruby	2,120	220
Ajax	8,660	280	Archer Class	1,770	225
Warspite ..	8,400	315	Hearty ..	1,300	212
Monarch ..	8,320	330	Nymphe ..	1,140	195
Northampton	7,630	280	Curlew ..	950	195
Audacious Class	6,910 to 6,010	280	Pheasant Class	755	165
Hecla ..	6,400	392	Traveller ..	700	161
Conqueror and Hero	6,200	270	Watchful ..	560	135
Inconstant ..	5,780	337	Rattlesnake Class	525	200
Belted Cruisers	5,600	300	Medway Class	363	110
Rupert ..	5,440	250	Torpedo Boats	137 to 28	150 to 86
Shannon ..	5,390	260	Coast Defence Vessels.		
Belleisle ..	4,870	245	Glatton ..	4,910	245
Leander Class	4,300	300	Prince Albert	3,880	240
			Cyclops Class	3,560	225

The great majority of naval officers with whom I have discussed this matter differ entirely from Sir N. Barnaby, and as, I think, with good reason. Even the limited experience of the recent Manœuvres proves that, for fighting in a seaway, ships of 3,000 tons and upwards are not practically on an equal footing. "Fighting weather" at sea is not a fixed or determined quality for ships of 3,000 tons and upwards. The possibility of any ship continuing to fight and maintaining speed depends largely upon her length and size, as well as upon her freeboard and the disposition of her armament

No one doubts that ships of 3,000 tons, or even of much smaller displacement, may be perfectly safe and seaworthy in any weather, and may be capable of fighting in bad weather. The vessels of the *Medea* class, for example, proved good seaboats; and as they carry two-thirds of their heavy armament on long poops and forecastles about 20 ft. above water, it would be very bad weather that placed them entirely *hors de combat*. At the same time it was obvious, when they were seen in rough weather alongside a belted cruiser of 5,600 tons, or the *Warspite* of 8,400 tons, that these latter had very superior powers of maintaining speed and fighting because of their greater size and weight. And if there had been present one of the new battleships of 14,000 tons, her advantages relatively to the *Warspite* would probably have been no less marked.

Experience shows that even in a very moderate sea torpedo gunboats can run down torpedo boats which in dead-smooth water would "show their heels" easily. Similarly as the sea rises, it would be practically impossible to continue to drive a torpedo gun-boat at anything like full power: considerations of safety would lead to the speed being eased down, under conditions when vessels of larger size (like the *Medeas*) could maintain their speed. But these, again, would have to be eased long before the *Warspite* would require to be similarly treated; and if the *Northumberland* possessed the requisite engine-power, she would in her turn surpass the *Warspite*, because of her greater size and length.

Similar remarks, *quâ* size, would apply to relative steadiness of platform and power of fighting the guns, if the armaments were similarly disposed; but these need not be amplified.

In speaking thus I do not desire to ignore the well-known fact that under certain conditions of sea, larger and longer ships may pitch and roll more heavily than smaller ships. I am dealing not with such exceptional circumstances, but with ordinary or average occurrences. At the same time it may be interesting to add that during the Manœuvres I repeatedly noted heavier pitching in the *Warspite* and *Black Prince* than was occurring simultaneously in vessels of the *Medea* class. Occasional heavy rolling of large ships has also been noted under conditions when smaller ships were comparatively steady. These exceptions will not, I think, shake the opinion of most naval officers that the largest ship is, for sea work, the best.

"Fighting weather" is a very elastic term. Modern appliances have done much to extend its meaning. I may mention one example. In the *Howe*, when placed intentionally beam-on to a heavy sea, and with the ship rolling through arcs of 35 to 40 degrees every 5½ seconds, the after turntable, carrying two 67-ton barbette guns, was cast loose and the guns successfully worked. Even under these conditions the ship could have been fought; but it is doubtful if a smaller ship would have been as well placed under the circumstances.

It will be noted that reference has been made chiefly to weight and size; but I am not oblivious of the great influence of *length* upon the maintenance of speed at sea. It is well known that in all recent designs for H.M.'s ships greater lengths have been accepted in proportion to displacement than have ordinarily been adopted. For example, the *Edgar* class of cruisers will have a length of 360 ft. for a displacement of 7,700 tons, as against 315 ft. for 8,400 tons in the *Warspite*. The *Apollo* class of cruisers are 300 ft. in length for 3,400 tons displacement, as compared with the same length for 4,050 tons in the *Mersey* class. This increase in length naturally arises from the high speeds aimed at in recent designs, and it will undoubtedly add to the power of maintaining speed at sea. Still greater relative length has been given to some foreign cruisers, which, as a rule, are more lightly armed than H.M.'s ships; and can therefore be constructed of different proportions. And in the Mercantile Marine, where the vertical distribution of weights is altogether different from that in war-ships, still greater relative length and narrowness are common; but it is the element of absolute length, and not ratio of length to beam, which is of the highest importance for maintenance of speed at sea.

This audience is well aware of the fact that the first-class passenger steamers of the first rank greatly exceed, in displacement as well as length, even the largest cruisers yet constructed (H.M.S. *Blake* and *Blenheim*). On this account it is unreasonable to expect that any regularly-built war cruisers yet contemplated can catch vessels like the *City of Paris*, or *Teutonic*, or *Umbria* at sea. Moreover, in these grand steamers the ratio of *load* carried—exclusive of hull fittings and propelling apparatus—to *total displacement* is altogether different from the corresponding ratio in a war cruiser. In fact they are designed for entirely different services and cannot well be compared.

It has been proposed that war cruisers should be built equalling these "greyhounds" in speed and coal endurance, but surpassing them in armament and protection. To do this must involve still greater displacement and cost; and one may well hesitate in embarking on such a course, so long as we possess not merely a vast superiority in swift merchant steamers available as auxiliaries to the regular fleet, but also larger war cruisers than are to be found in foreign navies.

In concluding my remarks on this section, let me say that, while I most strongly maintain the opinion that increased size and weight give great advantages in the maintenance of speed, steadiness of gun platform, power of concentrated attack and superior defence, I also hold that in the Royal Navy there is not merely room, but a positive necessity, for vessels of widely differing sizes and types. Furthermore, there is a concensus of opinion that no small proportion of our total force, particularly in the cruiser classes, should be of moderate size and cost, in order that a considerable number of vessels may be available without an inordinate outlay. For sea work and the line of battle, however, there seems good reason for the opinion generally held in the Naval service that ships of large size are absolutely necessary; while the conditions under which our ships have to serve, more particularly as regards coal endurance, practically necessitate that in any special class the British ship should be of greater dimensions than the foreign ship she may have to encounter.

II.—The Influence of Freeboard, Height of Guns above Water, and Disposition of Armament upon Fighting Qualities at Sea.

The fleet mobilised for the Manœuvres last year contained specimens of most of the classes of armour-clads and cruisers built during the last twenty-five or thirty years. Some of the latest constructions—such as the barbette ships of the *Admiral* class, the belted cruisers (*Orlando* class), and the protected cruisers (*Mersey* and *Medea* classes)—were in company with grand examples of the earlier ironclad period, the *Northumberland* and *Black Prince*, with broadside ships of later date (such as the *Hercules*, *Northampton* and *Audacious*), with turret ships of high and low freeboard, and with unarmoured cruisers possessing good sail power as well as steam.

It was possible, therefore, to make very interesting comparisons of fighting efficiency.

Taking first the question of *freeboard* one could compare—

(*a*) Ships of high freeboard throughout the length.

(*b*) Ships of moderate or low freeboard at the extremities, and high freeboard amidships.

(*c*) Ships of moderate or low freeboard at the fore end, but high freeboard for a portion of the length to the stern.

(*d*) Ships with long poops and forecastles, with moderate freeboard between.

(*e*) Ships with low or moderate freeboard throughout the length, with "flying structures" amidships for stowage of boats and other services.

Speaking broadly, the experience of August last confirms the conclusion generally reached beforehand, viz., that low freeboard forward puts a practical limit upon the power of driving ships against a head sea; while it entails a sensible increase in the expenditure of power required to maintain a given speed in a moderate sea, as compared with the expenditure in high-ended ships of similar form and equal size.

Lowness of freeboard aft is, of course, less important; but there were times during the Manœuvres when the low after-ends of the *Admiral* class, and of certain turret ships, were clean swept by the sea, and when a greater freeboard would have been advantageous, especially as regards habitability and comfort.

Lowness of freeboard throughout the length (as in *Devastation* and *Rupert*) necessarily intensifies discomfort, and reduces sea-keeping qualities.

High ends associated with moderate freeboard (or a "waist") amidships give good living quarters and an increased power of driving head to sea; but, while it admits of a smaller and cheaper ship being built to fulfil fixed conditions of speed, coal supply, armament, and protection, it entails some sacrifices in the way of "wetness" and discomfort when hard driven; as compared with vessels equally high-ended, but with a complete spar-deck. Everyone who saw the vessels of the *Mersey* class, for example, when hard driven in rough water, must have regretted that they were not built as first designed, with a flush upper deck. The *Warspite* and belted cruisers furnished good examples of the advantages of such a flush deck when steaming head to sea.

It may be interesting to state, in passing, that the Admiralty have decided, largely as the result of experience gained with cruisers during the Manœuvres, to construct a considerable number of the second-class cruisers building under the Naval Defence Act with flush upper decks. This entails increase in size and cost, but will add to the sea-going and fighting qualities.

Turning to the closely related questions of the influence of *height of guns above water*, and their *disposition* upon fighting efficiency, very brief remarks may suffice.

It had been previously demonstrated that in the low freeboard turret ships a moderate amount of sea made difficult or impossible the fighting of the fore-turret guns. Confirmation of this view was furnished in August last. Those who were present will not soon forget the contrast between the *Hero* plunging along towards Ushant against a long smooth swell (12 ft. to 15 ft. in height) with her fore-deck buried under masses of water and her turret guns practically unworkable, and the other ships with guns placed higher, and perfectly capable of fighting. In the *Admirals* on that occasion the low fore-deck was continuously buried under broken water, but the barbette guns (9 ft. to 10 ft. above the deck) were not affected. The *Melpomene*, rushing to the front in the chase—and placing herself in a position which in real warfare would have been certainly questionable—fought her 6-in. guns with ease, the *Hero* having no heavier gun to reply with. There were many other cases which might be mentioned, illustrating the disadvantages of guns placed low, but to these I need not refer.

This same incident in the Manœuvres may be used to enforce once more the undesirability of that extreme concentration of armament which deprives ships of effective stern-fire from heavy guns. The *Hero* has only one turret which could not be fought, and her pursuers had her at their mercy, as she could only bring one or two 6-in. guns to bear on them.

The *Inflexible* and *Ajax* represented the moderate freeboard central citadel ship with turrets, *en échelon*, placed close to the sides of the vessel. This arrangement is open to very serious objection, especially with long breech-loading guns; for even a moderate angle of roll or a moderate lift of the sea practically interferes with efficient fighting of the turrets, especially when trained nearly abeam.

Last year I sketched the reasons which have led to the very various dispositions of armament, as well as heights of freeboard and of guns above water, in modern warships. It is unnecessary to repeat what was then said. Further, it cannot be doubted that, under other circumstances than fighting in rough water, there are compensating advantages in lowness of freeboard and of guns—particularly as regards diminution of target and of surfaces requiring protection. On the other hand we have in the Royal Navy a very large number of ships of moderate freeboard, with guns at a small height above the decks; and in view of this fact it will be generally agreed that in building most recent ships with high freeboard, and guns placed at considerable heights above water, the Admiralty has done wisely, adding greatly to the power of our Fleet for what after all is its great necessity—fighting in the open seas.

Habitability, the power of maintaining speed, and of fighting in rough water, are all favoured by good freeboard. After all has been said about fighting efficiency, habitability claims some attention. Comfort to officers and men under the ordinary every-day conditions of peace-service must not be ignored. A great deal of nonsense has been written and spoken on this subject; not a little by persons who clearly had no real acquaintance with the ships they decried. For instance, I have read severe strictures on the accommodation, ventilation, and living quarters on the *Admiral* class, for which there was no foundation in fact. One gentleman went so far as to describe the "pasty-faced" condition of the crew as obvious to the casual observer. He drew upon his imagination freely, and described a hypothetical deterioration that must have been wofully rapid—seeing that, with the single exception of the *Anson*, none of the *Admiral* class was in commission more than two months, or at sea more than a month. Having lived on board one of the class for a month, and carefully inspected all parts of the vessel in all weathers, and at all times of the day and night, I emphatically deny the truth of these anonymous assertions. The living quarters for the crew are excellent in all respects—the officers have good accommodation. When battened down for several days the living spaces below the low ends are naturally not so fresh as when every hatch is open in harbour, but even to a landsman like myself there was nothing to seriously complain of, and my cabin at the extreme after-end of the ship was probably least favourably situated. The crew were much better off than the officers when battened down, a very large part of them being berthed in the main deck battery, where there was always good natural ventilation. Some increase in ventilation of the officers' quarters is admittedly desirable, and will be carried out, but no such change is needed in the crew space.

One inconvenience was suffered which has been much exaggerated. Certain minor defects of workmanship in the fittings on the low deck forward resulted in leakage of water into that portion of the crew space. The cables also were kept bent with anchors ready to let go. When the vessels were in rough weather, and the foredeck was continuously flooded, water did pass below and cause some discomfort; but these defects are easily remediable, and they will be remedied. It is well known that in the *Devastation*, when first sent to sea, the arrangements for watertightness, when battened down, were not altogether satisfactory, but experience has removed all trouble, and so it will be in the *Admirals*.

I may add that similar misrepresentations have been made of the living quarters in the *Medea* class, which compare very favourably, as a matter of fact, with those of any ships of equal size in the Fleet. These quarters are situated, as already explained, in the high ends under poops and forecastles, with good natural light and ventilation: not a man being berthed over the machinery or boiler spaces.

Further, it may be interesting to state that in the *Polyphemus*, a vessel of altogether exceptional character and low freeboard, where dependence has to be placed on artificial light and ventilation, and which has had a considerable period of service in the Mediterranean, the health of the crew is found to be exceptionally good, thus disposing completely of the "pasty-faced" theory above mentioned.

III.—Sea Speeds and Measured Mile Speeds of War-Ships.

This is a very thorny section of my paper, but so much has been said and written on the subject of late that it cannot be omitted. It seems probable that some public advantage may result, moreover, from the explanations I have to offer.

Members of this Institution do not require to have any statement of the real purpose and use of measured mile trials. Still, it may be well to remark that they are designedly and avowedly made *under the best possible conditions*—engines and boilers in perfect order, the best coal, skilled stokers, calm weather, smooth water, and clean, freshly-painted bottoms. Only under these conditions can such trials be of service either for purposes of comparing ship with ship, or of yielding information which will be of value in future designs. For war-ships of all nations, moreover, this system of trial is established, and the recorded speeds are measured mile speeds.

In recent years Admiralty practice in the trials of H.M. ships has been varied considerably, and always in the direction of greater stringency. It is said, although I do not vouch for the statement, that formerly various devices were used, classed under the generic term "jockeying," which gave to the measured mile results a character much beyond what was deserved, particularly as regards the development of power. Between the runs on the mile steam was "bottled up" to be used during the runs, and on the mile the steam blast was freely applied to increase development of power. If this were true in the past, it has long since ceased to be true.

In 1877 a regulation was laid down that, for the future, contractors' steam trials should extend over six hours' continuous steaming; the specified horse-power being attained as the mean of the power indicated over the six hours. When "forced draught" was introduced about seven years ago, the trials made with it were limited to three or four hours; the duration of natural draught trials remaining as before. About four years ago a further change was made, the duration of the natural draught trials being extended to twelve hours, when the season of the year permitted. After considerable experience it was found that this was an inconveniently long time for trial, especially in the shorter days, and eight hours has now been substituted.

All these trials are now made, at least for a typical ship engined by each firm, at *full load draught;* and the ships often have to take on board large weights of ballast for the purpose of bringing them down. The engineer contractors have no responsibility for speed, but guarantee development of a certain power for a certain period, with a certain approximate number of revolutions.

Sometimes these contractors' trials are made without placing the ship on the measured mile, distinct progressive speed trials being made, especially with new types of ships, in order to construct curves of speed, power, revolutions, &c. Then, knowing the revolutions and power obtained on the contractor's trial, the corresponding speeds can be determined from the curves. In other cases, during the contractor's trial, four or six consecutive runs are made on the mile to ascertain the speed. But the point on which I am now insisting is that the old practice of simply "running the mile" has long ago been abandoned, and that the speeds recently estimated as measured mile speeds for H.M. ships are those corresponding to powers to be developed over eight or twelve hours with natural draught, and three or four hours with forced draught. I much doubt if equally severe trials are made with the ships of any other navy.

Official records of speeds for H.M. ships in the Navy Estimates and elsewhere have also for some years past given both the natural and the forced draught speeds. In the Navy List only the forced draught power is given.

Passing from these standard trial conditions to the conditions of actual service, everyone having any acquaintance with the subject is well aware that there must be a considerable reduction made both in the powers developed and the speeds obtained. Engines and boilers will not remain in perfect order; coal is often of indifferent quality; stokers are not always equally efficient, nor can one expect from them over long distances work equal to that performed over a trial of a few hours; the bottoms of ships do not long remain clean, and it is rarely calm weather at sea. All these variable conditions affect actual performances at sea, and it is practically impossible to lay down any scale of even approximate reduction in order to connect smooth water or trial speeds with sea speeds for all classes and sizes of ships.

For years past, however, in Admiralty practice a rough rule has been followed, of which I have previously spoken here. It assumes that the maximum power likely to be developed continuously, for steaming at sea over long periods, will not be more than *two-thirds*, or less than *one-half* of the natural draught power developed on the contractor's trial. And further, recognising the impossibility of making any constant allowance for foulness of bottom, roughness of sea, or force and direction of wind, it has been our practice simply to record the speed which the reduced power would give if the vessel had a clean bottom and were steaming in smooth water. In the Navy Estimates for 1890-91, particulars are given for all the ships now building, not merely of the contractor's trial speeds and powers, but the approximate speeds and powers for continuous steaming under the assumed conditions of clean bottoms and smooth water.

A new regulation made about three years ago has given practical tests to this approximate rule for the ratio of power developed when steaming for long periods to the power developed on the contractor's trial. The Admiralty has ordered trials to be made in H.M. ships when newly commissioned, and in some cases after years in commission, extending over ninety-six hours, or such shorter time as might be found more convenient. This is clearly a severe test, especially in the case of newly commissioned ships, but the results have been eminently satisfactory, much more than fulfilling the office assumption. In Table B, I give the figures for a considerable number of ships, but prefer not to give the names. Most of these vessels are of quite recent design, but a few are of the older types.

An example or two may illustrate what is the effect of the explanations given above. The following are the results of trials and estimates for H.M.S. *Howe*:—

Contractors' trials—	I.H.P.	Speed. Smooth water, clean bottom.
Forced draught	11,600	16·9 knots.
Natural draught....	8,200	15·9 ,,
Continuous steaming (estimated)	4,500	13·5 ,,

TABLE B.

Duration of trial in hours.	Results of Trials. I.H.P. Actual.	Results of Trials. I.H.P. Contract.	Percentage of Actual to Contract H.P.	Remarks.
96	4,237	5,000	85·0	
96	640	900	71·0	
96	718	850	84·5	
76	1,807	2,300	78·5	
120	815	950	86·0	
96	546	600	91·0	
96	565	600	94·0	
73⅜	943	1,000	94 0	
80	2,225	2,200	101·0	Stopped on account of heavy head sea.
96	2,195	2,200	99·8	
96	989	1,400	71·0	
68¾	4,855	5,500	88·2	
58	843	850	99·0	
20	735	720	102·0	Stopped on account of weather.
14	730	720	101·0	Ditto
96	754	1,000	75·0	
85	545	720	76·0	
90½	1,995	2,100	95·0	Slowed for 5½ hours on account of rough weather.
96	613	1,400	44·0	Slowed on account of fog. Net time made up.
96	1,123	1,400	80·0	
90	685	720	95 0	

Here we have loss of 3·4 knots per hour from the forced draught trial to estimated working conditions, or of 2·4 knots from the natural draught trial. Anyone having only a superficial acquaintance with the matter might speak of the *Howe* as a 17-knot ship; ignoring the fact that "forced draught" is avowedly introduced only for full use over very short periods (three to four hours), when an emergency arises which makes the gaining of a knot or two in speed of supreme importance. But everyone familiar with the subject has recognised always the facts to which I now invite attention.

As another example I would refer to the case of H.M.S *Medusa*:—

Progressive trials—	I.H.P.	Speed Smooth water, clean bottom.
Forced draught	10,000	19·9 knots.
Natural draught	6,300	18 "
Continuous steaming (estimated)	3,500	15¾ "

This class of ship, probably because it is the last completed, has been the subject of considerable crititism, more especially on the ground that the intended speed has not been realised. As the designer of the vessels I may be permitted to state that the intentions of the design have been realised in all respects; not merely as regards speed, but also draught, trim, stability, and structural strength. The criticism arises from a misunderstanding of facts.

These vessels were designed to have a smooth water speed of 18 knots per hour with natural draught, when unsheathed with wood and copper: and it was anticipated that the sheathed ships would be about a quarter of a knot slower. The unsheathed *Medusa* on her trials attained 18 knots with natural draught: and the sheathed *Marathon* and *Melpomene* exceeded 17·6 knots with natural draught on their twelve hours' trials.

It was estimated that with forced draught (not exceeding two inches of water as air pressure) the unsheathed ships would attain 20 knots as a maximum speed, and the sheathed ships about 19¾ knots. In the first trial of the *Medusa* a speed of 19½ knots was attained, but the screws then fitted were clearly not suited for these higher speeds. Other screws were fitted; and with fewer revolutions, but the same power, the speed of 19·9 knots was reached. These new screws practically gave no better results than the preceding screws up to 17 or 18 knots which covered all working speeds: it was therefore decided not to change the screws of the other ships. Without any change of screws the sheathed *Melpomene* made 19·6 knots on her forced draught trial. In view of these facts, I think it will be admitted that the intentions of the design have been practically fulfilled.

The contrary opinion rests on a misconception. Prominence having been given to the forced-draught smooth water measured mile trial speed of 20 knots, it has been treated as if it were the sea-speed; but without any official authority. As a matter of fact, before the manœuvres began, a statement was issued to the fleet in which the speed of the *Medea* class for continuous steaming was estimated at from 15½ to 15¾ knots, and experience justifies this estimate. No doubt this speed could be exceeded for short periods; just as the chase in the North Sea the *Anson* and *Howe* steamed for six hours, and developed as much power over that period as had been developed on their contractors' natural draught trials. Further experience with all these new ships will doubtless give better results. It is often overlooked that it is no fair test of what ships can do to take the results obtained on a first commission of the temporary nature incidental to the manœuvres.

The introduction of forced draught has been described by a gallant officer as "an invention of the evil one"—presumably because it is associated with high temperatures. No doubt forced draught requires careful use, and may be abused. So far as I have been able to ascertain, however, naval officers who have had experience with forced draught are unanimous in desiring to have in their possession the power and control which it gives, although they regard it as a provision for emergencies, and not for everyday use. To be in a position to gain a knot or two in speed each hour for only three or four hours may be of the greatest importance in critical circumstances. To deliberately sacrifice this power, while it is retained in foreign war-ships, would be unwise. By circular issued rather more than a year ago, the Admiralty laid down special rules for the forced draught appliances. It has been determined that under ordinary circumstances the air pressure in the stokehold shall not exceed ½-in. of water; and this condition was fulfilled during the manœuvres. It is further ordered that "forced draught appliances are not to be used above the ½-in. pressure, except in circumstances of emergency, and then only for short periods, when the maintenance of the highest possible speed for three or four hours may be of great advantage."

One result of the use of forced draught has been to widen the gap between sea speeds and trial speeds, and hence, as I have explained, misunderstandings have arisen. But I must insist again that the facts have been clearly put before the public in official documents, and that our ships in this matter of recorded speeds are on the same footing as foreign war-ships. For all practical purposes, the natural draught trial speeds are, however, to be preferred to forced draught speeds, when comparisons are being made, because there may be, and have been, various degrees of "forcing:" and the Admiralty rule for maximum air-pressure has clearly not been adhered to in the trials of some foreign ships.

Another circumstance deserving notice is that the introduction, in recent years, of swift cruisers of small size has necessarily been accompanied by greater disparity between trial speeds in smooth water and speeds at sea. This is only another way of saying what has already been said—that the larger ship feels the check of the sea upon her speed less than the smaller ship, and may actually be capable of running down the smaller one at sea, although incapable of doing so in smooth water. This source of reduction in sea speeds is necessarily incommensurable.

So is that incidental to foulness of bottom. The fact is generally admitted, but scarcely appreciated as it ought to be, and it is so important that I will venture to give a recent illustration.

The *Medea* was ordered to be tried late in 1888 as a typical vessel of this class. Orders were given that her bottom should be perfectly clean and fresh painted at the time of trial. These orders were not fully carried out, and no anti-fouling composition was applied. The ship was also kept afloat for several weeks in the basin before proceeding on trial. These circumstances did not come to my knowledge until the trials were in progress, when it became obvious that some causes of seriously increased resistance or waste of power were in operation. The trials were stopped, and the vessel docked. Her bottom was found to be in a rough and dirty state, fully accounting for the unsatisfactory performance.

The sister ship *Medusa* was then tried under identical conditions of draught and trim, with engines by the same firm, and with screws of the same dimensions: the only difference was that her bottom was clean. In the *Medea*, 5,800 H.P. had been required to attain a speed of 16·9 knots: this power sufficed to give the *Medusa* a speed of 17·6 knots, and 5,000 H.P. gave her a speed of 17 knots. At lower speeds the difference was equally marked. For 13 knots the *Medea*, with a rough coating, required nearly 2,000 H.P., as against 1,600 H.P. for the *Medusa*, with a smooth skin. It will be understood that the condition of the *Medea* was not nearly so bad as that of many ships on actual service; and the figures given illustrate the importance of frequent docking and cleaning of the bottom in ships intended for high speed. They also furnish a strong argument in favour of the course taken by the Admiralty in giving wood and copper sheathing to a large proportion of the new cruisers now building.

IV.—Special Characteristics of War-ship Propulsion.

It is very much the fashion to criticise adversely the steaming powers of war-ships, and to contrast them unfavourably with those of mercantile vessels. This is done without reference to the essential differences between the services that have to be performed by war and merchant ships, or recognition of the inherent difficulties attaching to war-ship propulsion.

Speaking broadly, a merchant ship is built and engined for the purpose of steaming continuously at certain maximum speeds. Passenger steamers are constructed to cover certain distances, from port to port, at certain specified speeds. In fact, merchant steamers work under fairly uniform conditions of development of power and revolutions of engines, and everything is and can be regulated to give the best results under these conditions. Everyone on board is accustomed to fairly regular performance, and this fact greatly favours economy and efficiency, and their regular return to port enables constant attention to be given to desirable repairs or adjustments.

A war-ship is by no means similarly circumstanced. Assuming the simplest case, where she is proceeding alone, it will be found that she is not so favourably placed. Such passages, and most of her cruising, is done at low speeds, requiring only a small proportion of the power she possesses, in order that on occasion she may rush up to a high speed. This difficulty becomes greater as the upper limit of speed is raised. For example, the *Howe* can be driven at nine knots for less than 1,200 H.P.—not one-sixth of the power she can develop with natural draught for a few hours. Yet she has to carry about always engines and boilers capable of giving her a speed of over 15 knots with natural draught, and over 16½ knots with forced draught. The "waste work" inevitable under circumstances of this kind must be considerable at low cruising speeds, although every effort may be made to diminish it by using one of the twin-screws or other devices. In the *Blake* and *Blenheim*, with engines of over 13,000 H.P. natural draught, four sets of engines have been adopted, with special disconnecting arrangements, to permit of throwing out the forward sets when cruising at low speeds. In this great range of power, and small development under ordinary conditions, is to be found, doubtless, the cause of not a few of the difficulties which arise with war-ship machinery. Such difficulties would disappear if the engines were continuously worked at high speeds like those of merchant ships.

When a war-ship forms a unit in a fleet the case is still more difficult. It is a grand spectacle to witness the manœuvres of a large fleet, and to see these huge vessels changing formations while keeping stations accurately. But when one realises what is involved, particularly in the management of the propelling machinery and steering gear, the spectacle becomes even more interesting. Let me take a hypothetical case, and suppose the Fleet ordered to manœuvre at 9 knots. Every commanding officer would be compelled to have command of steam equivalent to a possible margin of speed of two to three knots, in order to ensure keeping station. This may seem little, but it involves a good deal. I will take an actual vessel for which the case stands as follows:—

9 knots	1,000 H.P.	50 revolutions.
11 ,,	1,800 ,,	60 ,,
12½ ,,	3,000 ,,	70 ,,

In order to secure the ready command of 10 revolutions, therefore, above the average ordered, 80 per cent. more power is needed to be available whenever ordered; and to have command of 20 revolutions, 200 per cent. margin of power is needed. Standing on the bridge, and taking observations continuously as to his relative position, the commanding officer is frequently obliged to vary the speed of the engines, and the engineer officers have to be ready to obey promptly the constant flow of orders from the deck. All this is mere matter of course to naval men, but to professional men it furnishes ample explanation of many otherwise difficult questions concerning the consumption of coal, or wear and tear of machinery in war-ships, as compared with merchant ships.

Take another case. A fleet is proceeding, with cruisers thrown out as scouts some distance ahead, say at the same speed of 9 knots. Let us assume that the *Medusa* is the cruiser. For 9 knots, about 550 H.P. only is needed in her—about one-third of what one of her four boilers would give at natural draught, when fully worked. Probably under these circumstances, fires will be banked in all the boilers. The Admiral signals suddenly to proceed with all despatch in some direction; let us assume it to be straight ahead. Now, clearly, some time will be necessary to work up from 550 H.P. to 3,500 H.P., or 4,000 H.P., and the regulations provide against rapid changes being made in the pressures of steam or temperatures of boilers. For purposes of illustration only let it be assumed that an hour is occupied in so working up to, say, 16 knots speed. Then the mean speed for the hour of the *Medusa* would be about 12½ knots, and although at the end of the hour she would be steaming 16 knots, she would only have gained 3½ knots on the fleet.

I commend this short statement to the notice of the gentlemen who, during the recent Manœuvres, were so greatly surprised that so-called swift cruisers when ordered to proceed with all despatch did not immediately rush off at full speed, and speedily disappear in the distance.

It is also very important to note that in a cruiser employed as a scout, with the fires alight, but banked in order to be in a position to rapidly raise steam, there can be no equation of the coal consumed to the power required simply to keep company with the fleet. The fact is obvious enough, but is not unfrequently overlooked.

Still another example. In the chase towards Ushant the *Hero* was steaming about 12 knots, with the *Howe* and *Rodney* attending her, and the *Camperdown* was keeping just outside the range prescribed by the rules. Let us suppose she was 2 knots distant. Suddenly she turns, and comes down upon the *Howe* and *Rodney* at a speed of 13 to 14 knots; so that her relative speed of approach would be 25 to 26 knots an hour. In less than five minutes she would be close upon her enemies, and if both kept on they would soon be far apart again. A spectacle of this kind impresses one greatly, and indicates how important a part in future naval actions the auxiliary armaments and quick-firing guns must play, for with all things at their best three minutes are necessary to re-load a 67-ton gun.

This paper has extended to a much greater length than I proposed, yet before closing I must allude briefly to one or two other points which have been brought prominently before the public.

There have been allegations, for instance, of *structural weakness* in some of the ships engaged in the Manœuvres. For these allegations there is no foundation whatever in any of the reports received. As an example of the loose way in which these statements are made, I may mention that a short time ago an officer from one dockyard was sent to another to take notice of certain small fittings in ships of the *Medea* class, in order that similar fittings might be carried out in the *Medea* and *Medusa*. It was immediately announced that he had gone to obtain particulars of structural strengthenings required in consequence of original weakness of construction. This erroneous statement was circulated far and wide; but it had no foundation whatever, as all the vessels of the class have proved to be amply strong, and almost entirely free from vibration, even when developing the full forced draught power. It would be idle to attempt to correct or contradict statements of this kind; but before this Institution it may not be out of place to allude to them.

There were a few instances, to some of which I have already referred, where minor defects of workmanship caused leakage and discomfort in some of the ships—not the *Medea*. None of these, however, indicated structural weakness.

Experience in these Manœuvres has led to alterations, or rather to additions, in certain classes of ships, which may be grouped under three heads.

(*a*) Additional ventilation has been found desirable, especially to engine and boiler-rooms placed under protective decks. So far as past experience could guide, the arrangements originally fitted might reasonably have been expected to prove efficient; but with increasing pressures of steam, greater powers, and multiplied auxiliary machinery, further ventilation was clearly necessary, and is being supplied.

(*b*) Greater facilities for intercommunication between engine-rooms and boilers at a low level in the ships have been proved to be absolutely necessary for safety and good working, and are being provided. Similar experience has, I know, been gained in some high-powered merchant steamers. Of course, this involves forming doors in bulkheads; but with the perfect drill in closing watertight doors now established in the Navy the interference with unbroken watertight subdivision can be accepted.

(*c*) Improved arrangements for the transport of coal from the upper bunkers to the fires in ships, with protective decks, have been shown to be desirable by the hard continuous steaming done during the Manœuvres. This matter had been very carefully studied in all recent designs, and it was clearly undesirable to pierce protective decks more than was absolutely necessary. The principle on which I have proceeded in the *Medea* class, and all subsequent designs, is to stow at least half the coal, and often a larger proportion, in bunkers below the protective deck and adjacent to the stoke holds. For the bunkers above, longitudinal transport has been arranged; so that all the coal can be readily carried where required and dropped into lower bunkers near the fires. All these arrangements stand good; the additions consist of three or four additional scuttles on each side placed within the bunkers and fitted with armour covers. I venture to state the facts, as it would appear from some published statements, that instead of the simple addition we had been engaged in some reconstruction of the vessels

In the belted cruisers similar but more extensive changes are needed to facilitate coal transport; these have been completed already in several of the vessels, and the others are in hand.

One very useful purpose of the Manœuvres is to discover any features in the ships, or their equipment, which can be substantially improved; and when, as last year, many new ships of different types are sent to sea for the first time, some such discoveries are inevitable. The foregoing remarks summarise all important suggestions received; besides these, there were considerable numbers of recommendations on minor points, which will be of service in building the ships now in progress.

In conclusion, let me say, while the test applied to H.M. ships by their temporary commission for the Manœuvres is necessarily a very severe one, and not of a character to show all that can be got out of the ships when officers and men have grown accustomed to their surroundings, it is a matter for congratulation that this great Fleet was brought together, sent to sea, and passed successfully through the Manœuvres without any accident worth notice. There were, no doubt, derangements of machinery, temporary troubles with boilers, and other incidents, which were not of an important nature. And it speaks well for the professional ability of the officers and men of the Navy that under the circumstances such excellent results were obtained. Had the Manœuvres lasted longer, still better performances would have been secured.

At the conclusion of the reading of Mr. White's paper, the following discussion ensued.

Admiral Mayne, as the officer alluded to in the paper who had described forced draught as "an invention of the evil one," asked leave to open the discussion, and while acknowledging that the forced draught might be necessary on the torpedo boats, remarked that the Admiralty had issued an order limiting the use of the draught in the big ships. Few officers, he took it, would use the forced draught even in emergencies with the risk of their engines breaking down altogether.

Sir E. J. Reed, M.P., expressed his agreement with Mr. White's view that the larger ships would be found to behave better in a heavy sea than the small ones, and he thought that the ships last designed by Mr. White would be found to be among the best ships of the Navy, and would justify Mr. White's contention that in ships of large dimensions would be obtained the best results in the sea performance. Respecting trials of vessels, he pointed out that the measured mile trials gave the means of comparison under different circumstances, and these comparisons could not be made under the circumstances of an American trial in sending a ship out on a four days' run. The fact that in driving a low freeboard vessel against a head sea, the same results were not obtained as by a high deck vessel—results not obtained in the measured mile trials—pointed to the value of a sea trial added to the measured mile trial. He was informed that the *Admiral* class of ships could not steam against a head sea and fight their guns, and also that parts of the report on this subject had been kept [illegible] from Parliament. As a critic of the Admiralty's action, he should like to say that he thought the Institution of Naval Architects might with him bear testimony to the immense value to the country of the naval autumn manœuvres. When he was at the Admiralty any amount of money might be got to build experimental ships, but none was to be obtained to try these ships, when built, at sea, and he was sure that it required a great deal of courage on the part of the present Board of Admiralty and the officers who promoted the action to institute the manœuvres. He was grateful to Mr. White for his paper, and also to the Board of Admiralty, who had given their sanction to the encouragement of discussions of this character on actual facts.

Admiral Morant bore witness to the capability of the *Admiral* class for fighting their guns when steaming at sea, and he stated that, having lived upon the *Anson* for some time, he could attest that there was no time when her guns could not be fought. As to the forced draught, he said he had made trials of this on two occasions, with the result that the ship could hardly crawl back into harbour, the forced draught so affecting the boilers. He expressed himself as disinclined to repeat the experiment.

Admiral Sir George Willes expressed his regret that no information had been given as to steadiness of platform under a speed of 16 or 17 knots, and said he should like to see a table of the number of oscillations per minute at that speed. He thought the power of using a forced draught was a very dangerous one to place in the hands of any captain.

Admiral Sir Vesey Hamilton congratulated Mr. White upon having gone to sea, and, hoping that this autumn he would repeat the experiment, trusted he would take some of his staff with him.

Mr. Sennett concurred with the opinions given in the paper as to forced draught, and preferred the term mechanical draught, by which was now meant the use of fans. This, he said, was no new plan, as fans had been used for some time in sending air into the stoke-holes. The defects which had been exhibited under forced draught in the tubes and boilers had resulted from an excess of the use of forced draught.

Mr. Durston, Engineer-in-Chief of the Navy, stated that experiments were still being made in respect to forced or assisted draught.

Admiral de Horsey considered this question of forced draught was a question of degree, and urged that if a standard had been come to there was no reason why there should not be a safety-valve for the stoke-hole as for the boiler.

Mr. Seaton insisted that there was no danger in forced draught properly used, and that for the evils complained of a remedy should be sought. The railway locomotives constantly used forced draught.

Mr. Martell, Mr. Archibald Denny, Mr. Yarrow (the torpedo-boat builder, of Millwall), and Mr. Ellis spoke, the last-mentioned not dealing with the subject of the paper, but referring to statements in newspapers respecting the condition of ships.

Mr. White, in rising to reply, first dealt with Mr. Ellis, who had shown a remarkable thirst for information respecting matters in the Navy. In many of the allegations Mr. Ellis referred to there was not one word of truth. A ship built by contract had, on trial, developed a vibration, and this was a puzzle to all concerned, until it was discovered that certain pillars had been left out, and the other ships, which had been properly executed according to plan, exhibited no vibration. He protested against his being called upon to account for newspaper paragraphs. The institution might take it from him that he should never go one iota below the necessary strength of a vessel of war. As to the possibility of fighting guns in the *Admiral* class in a head sea, he stated that the officer had the gun, by means of the machinery, completely in hand for firing at the proper moment, even in a heavy sea. As to the suggestion that the decks of these noble ships would be destroyed by firing the guns, he stated that this question had been set at rest by actual work. The platforms of these ships were steady. He then turned to the questions raised as to obtaining the power of high and continuous speed for war vessels—such as was possessed by the merchant vessels the *City of Paris* and the *Teutonic*. If the qualities possessed by these vessels were to be brought into a man-of-war, with her armament and fighting qualities, they must be prepared to pay the cost of giving coal endurance in addition to armament. On the subject of forced draught he should say very little, for when his paper was carefully read it would be found that he had anticipated many of the objections made in this discussion. An officer who was the strongest opponent of the forced draught, was asked whether he would prefer to dispense with the forced draught altogether, and he replied that he "would prefer to have it and use it only when he thought proper."

A cordial vote of thanks was accorded to Mr. White, on the motion of the President, Lord Ravensworth.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

An Important Announcement.

THE sixth general meeting of the session in connection with the North-East Coast Institution of Engineers and Shipbuilders, was held on March 10th, at the Literary and Philosophical Institution, Newcastle, under the presidency of Mr. F. C. Marshall. The Chairman stated that it would be within their recollection that the subject of medals for this institution was talked about some little time ago. The money subscribed by three gentlemen in West Hartlepool had now been paid into the bank, and interest was accumulating for the purchase of two medals for the best paper on naval architecture during the session, and for marine engineering being one gold medal for each subject in each session. He was sure there could be only feeling regarding this handsome contribution on the part of three members whom they did not often see, and who lived a distance from them, but who took so much interest in an institution affecting the whole of the North-East Coast as to be willing to subscribe so handsomely for the furtherance of the work of the association. It afforded him very great pleasure to move that the best thanks of this their general meeting be given to Mr. Christopher Furness, shipowner, of Hartlepool, Mr. Withy, and Mr. R. W. Vick, the donors of the sum for the purpose named. It was to be hoped this would be a stimulus to members of the institution, all of whom were free to compete for those medals.—Mr. Boyd seconded the resolution, which was carried.—The Chairman then said that in continuance of this movement, shipbuilders of the Tyne and the neighbouring river Wear had handsomely contributed sums of £20 and upwards for a further fund to be devoted to graduates and other members of the institution for other subjects than those already referred to; and particulars about the same would be given shortly.—Mr. R. L. Weighton read a paper on "The Institution's rule for the normal I.H.P. of marine engines and boilers." The reader remarked that marine machinery might be said to have two kinds of value—first, value to owner; and, second, cost to the builder. For the first point, he contended that the institution's rule embodied the factors which go to determine value, and was therefore a measure of value. Respecting the second point, the writer said he knew of no general rule which gave such a reliable basis cost as that given by the N.I.H.P. or the institution's rule. Lloyd's new rule for N.H.P., which was issued some time after the publication of the institution's rule, was no simpler than the latter, and its range of application was vitally impaired by the omission of boiler pressure. The writer also considered that it unduly handicapped short strokes and favoured long strokes, because of the adoption of the square root in dealing with the stroke. Whether regarded as an index of value to the shipowner or of cost to the builder, Lloyd's rule was therefore only applicable to engines of the same stroke, working at the same boiler pressure.—The discussion on the subject was adjourned to the next meeting.

A BROADSIDE LAUNCH AT MARYPORT.

THERE was launched, on March 22nd, from the shipbuilding yard of Messrs. Ritson & Co., shipbuilders, Maryport, a beautifully modelled steel four-masted sailing ship of the following dimensions, viz.:—Length, 289 ft.; breadth, moulded, 39 ft. in.; depth in hold, 23 ft. 6 in.; with a deadweight carrying capacity of about 3,200 tons. The vessel has been built to the highest class at Lloyd's, viz., 100 A1, under special survey, with poop aft for the accommodation of captain, officers, and a few passengers, the saloon being handsomely fitted up with walnut framing and bird's-eye maple panels, relieved by rosewood mouldings and carved capitals, and upholstered with Utrecht velvet; pilot house on poop deck, with entrance to cabin and chart-room; small house aft on main deck, for accommodation of apprentices and petty officers; large house forward for crew; galley and donkey boiler-house, topgallant forecastle for light towers and working anchors, with Emerson, Walker & Thompson's patent capstan windlass, worked by messenger chain from steam winch. She has four large hatchways, and will be provided with all the latest improvements for the quick loading and discharge of cargo, including donkey boiler and steam winch; also two large double purchase capstans on main deck. The vessel will be rigged as a four-masted barque, with steel lower and top masts in one, and double topsail and topgallant yards.

The event had long been looked forward to in shipping circles with peculiar interest, as it was a *broadside* launch. The yard of the Messrs. Ritson, who are the principal shipbuilders in Maryport, is on the banks of the River Ellen, which at this point is not more than 90 ft. across. This was, of course, found to be inconveniently narrow for launching large vessels in the usual way, stern first; and some years ago an experiment was tried, with a very small ship, of broadside launching. The result of this first attempt was awaited with some anxiety by those most concerned, but the venture proved a complete success, and since then the dimensions of vessels thus put into the water has been gradually increased.

On Saturday afternoon, the 22nd March, the Messrs. Ritson & Co. eclipsed all their former efforts, and put into the water this, the largest ship, with the exception of the *Great Eastern*, that has ever been launched broadside on. Thousands of people came from all parts to witness this novel launch, and every coign of vantage on the Moat Hill, which overlooks the docks and shipyards, was fully occupied. The whole proceedings were most successfully carried out, and as the vessel left the ways she was gracefully christened *Taconia* by Mrs. Ritson.

STEATITE AS A PIGMENT FOR ANTI-CORROSIVE PAINT.[*]

By Frank C. Goodall, Esq., Member.

HOW to efficiently protect the iron and steel work of our ships, bridges, and other iron and steel structures from rust and premature decay is a question which has long occupied that part of the public mind interested in the matter; and the fact that up to the present time no complete or satisfactory answer has been forthcoming is my justification for occupying your time with this short paper.

During my connection with various large shipbuilding establishments, and latterly with the Corporation of the Trinity House, I have had many occasions to observe how badly most materials used as anti-corrosive paints answer their intended purposes; and from my personal observation I have been led to devote considerable time and attention to finding a suitable material with which to form the basis of a protective paint, to take the place of those pigments, too numerous to mention, which have hitherto more or less failed in their object.

For many years I had the impression that the mineral steatite, commonly known as "soapstone," if it could be incorporated in an elastic paint, would possess qualities incomparably superior to the metallic oxide pigments generally used; just such qualities, indeed, as are needed in an anti-corrosive paint: and many were the unsuccessful experiments I made in this direction. The chief difficulty I met with in carrying out my ideas was this, that steatite when mixed as an ordinary paint, viz., with raw or boiled linseed oil, driers, turpentine, terebine, &c. (steatite forming the basis), would neither properly mix nor dry hard, and was quite useless as a protective paint. After further experimenting, and finding oil, driers, terebine, &c., would not act with steatite in the formation of a paint, I wrote a letter to the Press calling the attention of shipowners and paint manufacturers to the subject. Immediately afterwards I received numerous letters and calls in reference thereto. Among the first to visit me was a member of a well-known firm of paint manufacturers, who stated on their behalf that they had also experimented with steatite in the same direction, and that they had succeeded in embodying it as a pigment for paint with a quick-drying varnish: that their experiments up to date had proven that steatite as a pigment for an anti-corrosive composition was a success, and that they had acquired patent rights for the combination.

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[*] Read at the Thirty-first Session of the Institution of Naval Architects, March 27th, 1890.

Subsequent experiments and trials by myself have shown their statements to be well founded.

Steatite, soapstone, or potstone, is a soft magnesian rock, generally associated in its natural state with serpentine, chlorite, and talc, and is found in comparatively small contemporaneous veins in various parts of China, Chili, Italy, Germany, England, and elsewhere. It is incombustible, and for this reason is largely employed in the manufacture of asbestos goods, fireclay, &c. It is a good non-conductor of heat, an isolator of electricity or galvanic action, and is not affected by the acids which attack most metals. It is, in fact, unchangeable and unaffected by the highest and lowest temperature or the various atmospheric influences to which it may at any time be exposed.

Steatite has for generations been used in China and Japan for making idols, ornaments, images, &c., and also as a protective paint-wash for the coating of obelisks and other structures built of stone susceptible to atmospheric influences, and in addition it has been used to coat the native vessels inside and out, and, curiously to relate, as an anti-fouling paint for their bottoms. These obelisks, structures, &c., have been well preserved, owing to the qualities possessed by the mineral as already described.

On touching a piece of steatite with the hand it will be observed to have a very smooth, soapy nature (hence its popular name of soapstone). This remarkable smoothness, or soapiness, is due to the extreme minuteness of the atoms of which it is composed and to which it is possible to reduce it, and is one of the most striking characteristics of the mineral. Its extraordinary fineness and adhesive nature will be more fully realised when I tell you that it is possible to write with a piece of the mineral upon plate glass, the steatite finding a ready hold on its highly polished surface.

It is this property of the mineral which in my opinion gives it its greatest value as a basis for protective paint, enabling it to secure, without the slightest chemical action, full and permanent adhesion to the close fibre of steel and iron, which the greatest number of paints in my experience have hitherto failed to do.

With regard to this statement, I am now in a position to speak from personal observation, and to say that paint containing steatite as a pigment will find perfect and permanent adhesion when applied to the true surface of the smoothest steel, and that several large steamers already coated with it have shown no signs of rusting or the paint scaling off. My experience also with this composition on iron ships has been precisely the same.

In the case of iron vessels, as you are all, of course, fully aware, the corrosion does not proceed in the same way as with steel, and the after effects are not so serious.

Even in the case of new iron ships it was a common thing to see them dry-docked after running six or eight months, with their bottoms in a state of considerable corrosion, and with hardly a vestige of paint left. However, the rust roughened the surface of the plates, and, after having been cleaned and repainted, the paint was able to find far better adhesion, and apparently all alarming indications of further damage were gone. With steel ships it is very different. Many here have, doubtless, observed the result of using metallic oxide pigment paints on steel ships during the last five years, and most of us have seen steel vessels, which have been painted at proper intervals, with, we will presume, the best paints procurable, deteriorated to such an extent that it has become necessary to cut out and renew many of the affected parts, thereby causing great delay, inconvenience, and expense to the owners. The rusting is of an uniform character, and leaves the plates almost as smooth as when the ship was built, and when cleaned and repainted the oxide again accumulates with exactly the same results, but in this case, owing to the more rapid corrosion of steel, when exposed to hostile agencies, it is only a matter of a few months to find great damage existing and mischief going on

Hence the paramount importance of finding a composition which will permanently adhere to the fibre of the metal, and so prevent the corrosive action which has proved such a constant anxiety and heavy expense to shipowners.

That Lloyd's Registry have recognised the susceptible property of steel and the inefficiency of the ordinary paints in present use, is evident by the fact that they have commenced to gradually reduce the advantage in the way of thickness of material over iron ships, formerly conceded to vessels built of steel, and they acted wisely when they decided, after classing steel ships in their highest grade, and finding that they were continually corroding inside and out in spite of protectives, to insist upon additional heaviness to the scantlings in order to prolong the life of the ships to a reasonable period, or at least to a period equal to that of an iron-built vessel.

The reduction originally allowed by Lloyd's Register to steel-built vessels was 20 per cent. (although, as a matter of fact, owing to some iron being used in the construction, it seldom exceeded an average of 16 per cent.); but at the present time it varies from 9 to 12 per cent. in the aggregate, according to the requirements of Lloyd's Committee and the quantity of iron used.

Taking as an example the case of a vessel, say, of 4,000 tons deadweight, the addition to scantlings which Lloyd's Registry have added during the last four years involves an additional cost of about £450 for material and labour, and reduces the ship's carrying capacity from 35 to 40 tons

I think you will agree with me that these figures are important, as showing the growing disadvantage that steel shipbuilding labours under; the only antidote and remedy for this disability is the introduction of a real permanent protective coating for the steel of which these ships are built.

My argument is that there is in steatite the basis of a real and permanent protection, and I venture to say that when such a composition is generally used by shipowners, and Lloyd's Registry have recognised that by its means the existing incessant corrosion is permanently restrained, they will certainly give the subject consideration, viz., the advisability of reducing the steel scantlings to the former sizes.

During the time these amendments to Lloyd's rules were made, competition in shipping was so keen that shipowners could ill afford to bear any additional cost, coupled with reduced carrying capacity; and there is no doubt they would appreciate a material which will not only permanently protect their ships, but will probably enable them at no distant period to build their steel ships of the former carrying capacity and at a consequently reduced cost.

Now, when I say that steatite will effectually protect steel from rust, I do not mean that it will protect it in the same way that a metallic oil paint protects iron, but that once properly applied to the true surface of the steel, it is indestructible, and there will be absolutely no rust on the parts coated with it, or, in other words, such ships will attain a much greater age than iron ships have hitherto done.

It may be well at this moment to refer to the causes of rusting. They are :—

Firstly, contact with sea water and the various acids it may contain.

Secondly, atmospheric influences.

Thirdly, electric or galvanic currents.

Now, the first two can be cured by preventing the sea water and the atmosphere from coming into contact with the steel. In order to do this it is necessary to have a paint which will adhere to the fibre of the steel, which will be perfectly air and water-tight, and which will have sufficient elasticity not to crack with the vibration of the vessel or the slight expansion and contraction of the steel. This elasticity may, in my opinion, be obtained in steatite by using a suitable varnish to convey it to the steel in the form of paint, which varnish should contain evaporating spirits, combined with a certain proportion of slow-drying oils, in order that the paint may dry and at the same time keep its elasticity. Varnish alone (as I have often practically proved) is porous, and admits the atmosphere and moisture to the body coated with it; but when mixed with steatite, owing to the minute atoms of which it is composed, as already described, the fine pores are completely closed, and the paint becomes air and water-tight.

It is thus that steatite answers the double purpose of enabling the composition to adhere to the steel, and making it completely air and water-tight. Of course, under the continued influence of sea water the varnish would gradually perish from the outside, and the coating would have to be from time to time renewed, but against atmospheric influences the protection would, in my opinion, last many years.

The third cause of rusting is due to electric or galvanic actions. At the spring meeting of this Institution in April last, Professor Lewes treated this subject most exhaustively, and I would not presume to attempt to throw any fresh light upon it. I will therefore simply confine myself to the question, To what extent can steatite be used to prevent the action of electric or galvanic currents upon iron and steel?

The gums of which varnishes are manufactured are, like steatite, isolators of electricity. Consequently, if a vessel's iron or steel plates inside and out, together with all iron or steel attached thereto, are properly coated with steatite paint, they are therefore completely isolated, and unable to absorb electricity or galvanism from the atmosphere, sea water, &c., as they certainly do if coated with paint made from metallic pigments.

Whether such a coating can be given in the many small parts of the ship so difficult of access, of course, remains questionable, but there is, in my mind, no doubt but that a complete isolation of all steel and iron parts of a vessel would reduce the absorption of electricity or galvanism to a minimum, and would thus almost remove an important cause of the rusting of ships and other iron or steel bodies, which now goes on to such an extent, even when they appear well protected by paint.

For what other purposes steatite may be useful in connection with shipping need not be discussed in this paper, but I hope at some future time to bring forward another subject, treating of this mineral.

I will only add that steatite or soapstone, as a pigment for anti-corrosive paint, well deserves the careful attention of the members of this Institute.

FRICTION OF SCREW PROPELLING ENGINES.

A MEETING of the Institute of Marine Engineers was held on Tuesday evening, March 4th, presided over by Mr. L. P. Coubro', when Mr. W. J. Nowers Brett (Associate) read a paper on the "Friction of Screw Propelling Engines."

The Chairman in introducing the author of the paper remarked that it gave him a double pleasure to preside over the meeting inasmuch as Mr. Brett was the first associate who had come forward with a paper to read before the Institute, and he was at the same time one of the apprentices brought up by his own firm (Messrs. Lester & Perkins).

The paper dealt with the losses due to the friction on the various working parts of the marine engine, from the pistons to the propeller blades. The question of rough surfaces and lubrication were first referred to, also the small bearing surfaces sometimes found in engine shafting and the consequently ensuing trouble. The forms of steam admission valves in use past and present, and the rejection of the slide for the piston valves in more recent types of engine were noted, and the advantages of the piston valve pointed out. Reference was made to the different kinds of material used for bearing bushes, *lignum-vitae* for the propeller shaft in the stern tube, brass, white metal or phosphor bronze for the various other bearings. It was suggested that it would be an advantage to use roller bearings for some of the shaft journals. A model of roller bearings suitable for tunnel and other shafting made and patented by Mr. Leslie, one of the members, was exhibited. A passing reference was made to shafting being out of line, and the advantage of having flexible couplings fitted to the tunnel shafting to obviate the trouble frequently experienced, whether due to original lining off or to the alterations which take place from time to time in the hulls due to the loading of varying cargoes or structural weakness. The best material to use for propeller blades was questioned, and reference was made to the extensive corrosion or pitting found to take place at the points of the blades in both cast-iron and steel after a few months running. At the conclusion of the paper the discussion was entered into by Messrs. Shorey, W. Wilson, R. Marshall, J. W. Dimmock, J. McF. Gray, and Mr. Leslie; Mr. G. W. Buckwell's remarks, in his absence, were read by the Honorary Secretary.

The question of the most suitable form of packing rings for pistons was considered, and several members expressed opinions favourable to a series of narrow cast-iron rings as being economical and least liable to cause excessive friction. The once common practice of giving packing rings too much compression was commented upon strongly, this leading frequently to a system of packing being unjustly condemned on account of undue compression being placed on the rings.

The great unbalanced weight of the slide valves fitted to many engines—especially the high pressure valve of compound engines—was remarked upon as obviated to a certain extent in more recent types of engines by the piston form of valve which cannot, however, be looked upon as perfect in its duty of keeping steam-tight in the chamber. The arrangement of a balanced or equilibrium slide valve patented by Mr. Church was commended in high terms by several present who were acquainted with its merits. The introduction of phosphor or manganese bronze and delta metal for propeller blades was considered by a few members who had experience of them as compared with cast-iron or steel to be a very great improvement, although expensive in first cost, the improved speed of the ship with less drag on the engines, and the fact that the action of the water at the periphery of the propeller does not cause any pitting action such as is found in the cases of iron and especially steel blades involving frequent renewal, all tended to the view that in the end the new metals were the most economical. The principles and theories of friction on moving surfaces were discussed, and a most interesting series of remarks on this subject, with data gained from experiments, were given by Mr. J. McF. Gray,' quoted from the transactions of the Institute of Mechanical Engineers.

The proceedings were brought to a close by votes of thanks to the author of the paper, and the chairman moved, and seconded by Messrs. W. J. Craig (jun.) and W. Gale and Messrs. R. Adam and D. Green respectively. It was decided to continue the discussion at a future meeting early in April.

The Annual General Meeting will be held on the 28th March, when the financial and other reports for the first year of the history of the Institute would be submitted, and the results of the voting papers for the election of the new council declared. We hope that now the Institute has gained confidence, and is fairly established, the time is not far distant when it will have premises of its own, and rooms for educational and other purposes worthy of the name. The intentions of the promoters of the Institute are such that they merit the support of all who are interested in the prosperity of the merchant navy, and we commend the cause of the Institute to those whose liberal support will enable the promoters to come within reach of the goal at which they are aiming.

COAL.

A MEETING of the Institute of Marine Engineers was held on Tuesday evening, March 11th, in the Laugthorne Rooms, Stratford, when Mr. G. Ll. Morgan read a paper on "Coal."

The meeting was presided over by Mr. J. McFarlan Gray (vice-president) who intimated the subject, and briefly introduced the author of the paper.

The paper dealt chiefly with the historical and descriptive aspects of the subject. Beginning with the earliest notices on record of coal being used for fuel, and referring briefly to the notices of carbon in ancient history as probably charred wood or charcoal, the writer went on to point out several epochs in the history of coal as when (1) introduced for domestic purposes, (2) condemned by the citizens of London for polluting the atmosphere of the city by its smoke and its use forbidden, (3) re-introduced in consequence of the scarcity of wood pressing on the citizens, (4) the use of coal for the manufacture of gas, and its introduction to public service, (5) the use of prepared coal for smelting iron and steel. Under these several heads some very interesting records were given of the discovery of coal itself, of the remains found in the coal seams and adjoining strata, and of the difficulties experienced in working and introducing it. The various descriptions of coal were noted with their characteristic features and the districts in Wales where each prevails.

In concluding, the question as to which quality of coal is best for steamship use, including the patent block fuels which are used by many, was asked. The stowing quality of the block fuel, both in respect to ease in handling and cleanliness, appears to give it a great advantage, added to which it is made from the waste remains which accumulate at the various collieries and should, therefore, be cheap, and its use encouraged. The evaporative power, and the qualities of the different kinds of coal, and the suitability of each kind for the various purposes for which coal is used, were carefully entered into, and the paper concluded with a reference to the introduction of oil for fuel as well as for lighting purposes.

The discussion which ensued was entered into by Messrs. Bruce, Thomson, Langley, W. White, Sage, W. Wilson, Watson, Noble, Coubro', Duff, Adamson, Daniels, J. Mc. F. Gray, and others, who in the course of their remarks dealt with the evaporative power of the various kinds and qualities of fuel under natural or forced draught, from which it appeared that under certain conditions of stokehold and boiler arrangement north-country coal gave equally good results with Welsh: while in several cases cited, the block fuel appeared to give results in no way inferior to good steamship coal. Reference was made to a new patent fuel presently coming into the market, as being a composition of petroleum manufactured into a solid state, and from which great results are anticipated.

Several speakers pointed out that a very grave mistake was made by manufacturers of patent block fuel in not keeping up the quality of the fuel, due either to carelessness in the manufacture or in mixing the ingredients, as it seemed to be the opinion that the quality varied considerably even without a variation in cost.

Mr. J. McF. Gray gave an exceedingly interesting lecture on the elements and preparation of coal, pointing out the wise and beneficent provision made by the Framer of the Universe in the early ages before history began, and by means of which man is now enabled to conduct enterprises of a nature undreamt of by past generations.

The theory of heat and combustion was dwelt upon, and to some extent illustrated, and the proceedings, which were of a highly interesting and instructive character, were brought to a close by votes of thanks proposed by Messrs. Carrick and Duff, to the author of the paper and the chairman respectively; these were heartily accorded and suitably acknowledged.

Experiments with the coal-testing apparatus belonging to the Institute were conducted at the close of the meeting to illustrate some of the remarks made in the course of the discussion.

The honorary secretary announced that the next meeting of the Institute would be held on Friday, 28th March, that being the annual general meeting, the financial and other reports would be presented, and the next following meeting would be held on Tuesday, 8th April, when the adjourned discussion on the "Friction of Screw Propelling Engines" would be continued.

BOILER FURNACES.*

By W. Kilvington and Alex. Taylor.

RECENTLY the thickness of the plates forming the furnaces of marine boilers has been increasing, but they have now got to a thickness beyond which a good many engineers hesitate to go, and therefore at this time a discussion of the question whether to go farther or to stop will be both opportune and valuable. Not very many years ago a plate of ⅝ in. was considered the thickest that could, or at any rate should be used for a furnace, and the supplement to Spon's *Dictionary of Engineering* says that plates of as great a thickness as ¾ an inch have been used; but this information is accompanied by a warning that serious results may be expected to follow. It is some time since any hesitation was felt in using ½ in. plates, and at present very few engineers, the writers believe, object to plates ⅝ in. thick, but they think that even this thickness may be greatly increased, and one of their chief objects in writing these short notes is to elicit the opinion and experience of the members of this Institution regarding the employment for high pressure marine boilers of what would be usually designated *thick* cylindrical furnaces.

The writers have advocated and employed from the very commencement of the introduction of high pressure triple-expansion engines for marine purposes plain cylindrical furnaces—that is, furnaces without corrugations, rings, or change of form and section of any kind; and they are able to assert, after years of experience of their use, that such furnaces have given no trouble, and have been in every respect satisfactory up to a thickness of ¾ in.; and their confidence is such after this experience that they would not hesitate to still further increase the thickness if the circumstances of the case required it, and they now ask (and this is the essence of the whole question) if there is any proof and example of a case where a furnace has failed in any way merely on account of its thickness being too great?

This question is very important at this time and to this district, because here a large number—we believe the larger proportion of furnaces for boilers built on the Tyne—are now made of the "plain" description, and because the Board of Trade demur to pass furnaces if they are made of a greater thickness than ⅝ in. The reason given by the Board of Trade for this is that they have no proof that the temperature in the thicker plates is not so much raised as to reduce the factor of safety. We think that this is not the case, because of the deductions to be drawn from experiments and formulæ to be presently referred to, but especially from the fact that we have had thicker furnaces in use for the last eight years at sea which have not changed in form, and are in every way effective to-day. The writers have knowledge and complete reports concerning furnaces in boilers of 160 lbs. pressure, made of about ¾ in. plate, which have now been worked continuously at sea from three to four years.

These furnaces are steel. If they had been iron, which is more subject to lamination, some of them probably would have failed from this cause. The reason for the failure of a laminated plate will be referred to further on.

The important points to investigate in connection with furnace plates would appear to be (1) the influence of the thickness on the transmission of heat through them, and (2) the effect of this thickness in raising the temperature of the interior of the plate. With regard to transmission of heat, it can be shown that the sum of the resistances at the two surfaces is so much more than the resistance to conduction through the body of the plate itself, that any thickness likely to be required to furnish strength due to compression or length can have little effect, and certainly would not be prohibitive or dangerous. The writers' experience of hundreds of, what would be called by some engineers, very thick furnaces, confirm this statement.

Rankine, in his work on the steam engine, gives the total thermal resistance of a plate

$$= (\sigma' + \sigma) + s\,x,$$

when $(\sigma' + \sigma)$ is the resistance of the two surfaces, and $s\,x$ the internal resistance of the plate to conduction of heat.

We have given

$$(\sigma' + \sigma) = \frac{1}{A \left\{ 1 + B\,(T' - T) \right\}}$$

when $s = \cdot 0043$ for iron,
$x =$ thickness in inches of plate,
$A = 1\cdot 58$ for dull metallic surfaces,
$B = \cdot 0037$ " "
and T' and $T =$ the temperatures of the fluids in contact with the two surfaces.

The writers propose to take $(T' - T) = 3{,}000$ degs., which is a much larger value than is likely to obtain in most marine boilers. But this will be referred to again.

If we compare, according to the above formulæ, the resistance of ⅝ in. and ¾ in. plate, we find that the total resistances are as 550 : 555. That is to say, that by adding an ⅛ in. to the thickness of a ⅝ in. plate the resistance it offers to the transmission of heat is only increased about 1 per cent. This shows how little mere thickness can have to do with this part of the question. But this was well known long ago, for Rankine says:—

> "The external thermal resistance of the metal plates of boiler flues and tubes, and other apparatus used for heating and cooling fluids, is so much greater than the internal thermal resistance, that the latter is inappreciable in comparison; and consequently the nature and thickness of those plates has no appreciable effect on the rate of conduction through them."

And he also states that the results of experiments on evaporative results of actual boilers justifies the disregard of the effect of thickness on the rate of transfer of heat.

Mr. Isherwood made some experiments in 1867 on the transmission of heat through plates varying from ¼ in. to ⅝ in. in thickness where one side of the plate was exposed to steam and the other to water, and he states that the thickness did not measurably influence the result. It is true that those plates are not very thick; but the variation in thickness is very considerable, and as far as the experiments go they afford a remarkable confirmation of what has just been stated.

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* Read before the North-East Coast Institution of Engineers and Shipbuilders, on February 14th, 1890.

In the instance here given, of course the plates were clean, that is, they had no "scale" on them, but it is probable that scale would affect the action of a thin plate in the same way as a thicker one, and apparently they are on a par in this respect. But heating and distortion due to scale and many other causes is often only local, that is over a small surface; and in case of any distortion of this kind a thick furnace would probably be much safer than a thin one, as the plate would be stiff enough to resist any dangerous change of form adjacent to the over-heated portion; besides the stiffness would check the distortion of the over-heated portion itself, owing to the support it would afford.

There can be little doubt that so far as the quantity of heat transmitted through the plate is concerned, the thickness can be still further increased, but the increased temperature of the plate itself due to this increase has yet to be considered. The writers at once admit that this part of the subject, although much more important than the first, is not so clear, and the investigation of it much more difficult. Considerable thought has been bestowed, therefore, on this point, and the writers hope that at least an approximate determination of the temperature in the plate has been arrived at by the method now to be explained.

Above is a calculation of the total increase of resistance to transmission of heat for a ¾ in. as compared with a ⅜ in. plate; but the writers think that the employment of an 1 in. plate would be quite safe for a boiler furnace, and the figures which follow refer therefore to a plate of this thickness. Taking the same formulæ as referred to in that calculation for 1 in. plate and 3,000 degs. as the difference of temperature between the fire in the furnaces and the water in the boiler—which we may call the *head* of temperature which is available to cause the flow of heat from the gases to the water—it is found that—

[*] $\sigma : s : \sigma' :: 506 : 43 : 17 = 2{,}682^\circ : 228^\circ : 90^\circ$ (sum = 3,000°)

That is that the head of temperature between the furnace gases and the inside surface of the furnace plate (that is the side exposed to the fire) is 2,682 degs.; and the difference of temperature between the inside and the outside surface of the plate itself is 228 degs.; and the head of temperature between the outside of the plate and the water in the boiler is 90 degs. This calculation—as will be seen at once—entirely depends upon the assumption that the head of temperature will be proportionable to the resistance, which seems a reasonable assumption, and which it is believed cannot be far from the truth.

Taking this, it follows that the mean temperature of the plate, if we take the temperature of the water due to steam of 160 degs. pressure, will be 370 + 90 + ½ (228) = 574 degs., which would be the temperature somewhere about the middle of the thickness of the plate; but even if, as might be urged, the extreme inside temperature should be taken, then it is still only 688 degs.; and since, we believe, iron up to 600 degs. is not deteriorated in strength, it may be said that a plate of this thickness is within the limit of safety, as any decrease of strength at 688 degs., if it takes place at all, must be very small.

If this calculation is true, then the temperature of a furnace place is much nearer the temperature of the water in the boiler than that of the heated gases in the furnace, due to the very great resistance at the surface in contact with the light heated air and gases. The relative resistances here given are quite confirmed by observations on the reverse process of cooling heated metals in gases and in liquids.

The failure of a plate having a laminated portion in it is now readily explained, for that portion of the plate which is on the fireside being bounded on two surfaces by air or gas offers so much resistance to the escape of heat on the side furthest from the fire that the plate is heated to such an extent as to expand into an arched shape, forming what is called a "blister." This was an occurrence, unfortunately, only too frequent when iron plates were employed.

It may be surmised here that it is probable steel plates will offer less internal resistance to the transmission of heat, and will therefore be less raised in temperature, on account of their homogeneous nature, than was the case with iron plates, which had to some extent a fibre running across the direction of transmission of heat, and therefore most likely unfavourable to it.

In conclusion the writers wish to point out that they have in their calculations taken the temperature of the fire as high, or even higher than is likely to be got in a marine boiler furnace as at present worked. If we calculate the transmission of heat to the water in a boiler working at 160 lbs. pressure, and if the difference of the temperature at the furnace was 3,000 degs., and the temperature of the chimney gases 670 degs., we find that each square foot of heating surface transmits 16,650 units of heat per hour, and as each lb. of coal burnt, supposing a total value of 14,500 gives under these conditions of working 12,000 to the boiler, then for each foot of heating surface we should have to burn $\frac{16{,}650}{12{,}000} = 1{\cdot}38$ lbs. of coal, and as a common proportion of heating surface is 30 square feet per foot of grate, we should have to burn nearly 42 lbs. of fuel per foot of fire grate to maintain these temperatures. This is more than double the quantity almost ever burnt, therefore the case that has been taken is an extreme one.[†]

Of course whatever reasons can be adduced for thickening up furnace plates applies equally to the plates of the combustion chambers and the importance of the whole subject, especially in view of the probable further increase of working pressure in marine practice, must be very great to an Institute like this, and therefore merits its earnest consideration.

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[*] In some experiments the writers made they found that the resistance to transfer of heat from a metal surface into air to be 30 to 35 times the resistance into water. Taking the least of these $\sigma \times \sigma'$ are proportioned 30 : 1.

[†] Rankine gives an approximate formulæ for quantity of units of heat per hour transmitted to water in boiler $\frac{(T'-T)^2}{200}$.

Let $T' - T = D$ difference of temperature, then mean value on

$$D^2 = \int_b^a \frac{D^2 d.D}{a-b} = \tfrac{1}{3}\frac{a^3-b^3}{a-b}$$

(which may be written for ease of calculation

$$\tfrac{1}{3}\left\{a^2+a\,b+b^2\right\}\ )$$

when D is taken between the values a and b; and this divided by 200 gives units of heat transmitted = 16,650 (about) in the case above.

And if E and e be the *elevations* of temperature of the fire and the funnel gases above atmospheric temperature, then each lb. of coal will give to the water $14{,}500\,\frac{E-e}{E}$ units = in case under consideration 12,000 (about). It follows from this that $\frac{E-e}{E}$ = the efficiency of a boiler. The similarity of this equation *in form* to that for a heat engine is perhaps worth notice.

THE MANCHESTER SHIP CANAL.[*]

THE full value of the Manchester Ship Canal can be best understood by those who have some knowledge of commercial geography, by those who know something of the trade of this district in relation to the commerce of the world.

Manchester is now Cottonopolis, and has been for nearly a century. Barcelona, in Spain, for nearly a thousand years before this was the Cottonopolis of Europe, and before the Christian era probably the trade would be divided between Bagdad and Alexandria.

The face of Europe has been changed by the mechanical inventions of this country. Even after James Kay had invented the fly-shuttle and quadrupled the power of the weaver in 1738, Barcelona was still the chief city of the cotton trade, both for the raw material and manufactured goods. The Peels and many other Lancashire firms had offices in that ancient port.

Cargoes of cotton were landed there from the West Indies, and in comparatively recent times the return cargoes were slaves from the African coasts. The cotton for Lancashire was brought by English boats to Liverpool, and then sent to the mills and warehouses. At one time Bolton did more business in yarn and cloth than Manchester, but towards the end of the last century the Irwell having been made navigable and the Bridgewater Canal completed caused Liverpool to be placed in direct communication with Manchester by water. This, with the various mechanical inventions of Lancashire men, and the introduction of steam power consolidated the position of the Manchester district for textile goods and machinery, and seriously interfered with the commercial prosperity of Barcelona.

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[*] Read at the Spring Soirée of the Manchester Field Naturalist and Archæological Society, at the Memorial Hall, Albert Square, Manchester, March 19th, 1890, the Mayor of Manchester in the chair, by Alderman W. H. Bailey, ex-President of the Manchester Association of Engineers; Member of the Board of the Manchester Ship Canal Company.

Ninety years ago two large British ships a day entered the port of Barcelona chiefly for cotton, and forty years later not one vessel a week entered that port.

James Watt, the inventor of the black slave—the steam engine—seemed to enter into partnership with William Wilberforce in this contest for commercial supremacy. The return cargoes of the slave-dealers ceased to be profitable, for our clipper ships placed upon the Atlantic to suppress the slave-trade stopped the traffic, and this second blow completely annihilated the Spanish mercantile marine.

It is impossible to ignore the metal trades which have not only had changing centres in Europe, but have been peripatetic even in this country. Wigan was the chief centre of the iron trade four hundred years ago in the north, and Lincoln, Suffolk, Sussex, and London in the south. Before the Christian era Alexandria was the chief city for steel-yards, hydrometers, and fine instruments. Florence in later times became not only the chief city for scientific instruments, but it was also famous for physical investigations and for those discoveries which paved the way for the inventors of the steam-engine. All the cast iron pots and pans that came into this country before the last century were of Dutch manufacture.

Our commercial supremacy has only been achieved at a comparatively recent date. It is profitable to know that there have been intellectual and moral forces, as well as physical causes, which have placed us in the primacy of the races of the world in trade and commerce.

We must not ignore those forces if we are to maintain our position, for it must not be forgotten that for textile manufactures we have to send to all the corners of the earth for our cotton, flax, silk, hemp, jute, and wool. We also import iron in great quantities from Spain, and timber from Norway and Sweden, and many other countries. Every step made by us to cheapen our powers of distribution, every obstacle removed between us and the plantations, minerals, gardens, cities, and peoples of the earth give permanence and solidity to our commercial position, every improvement in steam ships is of public concern, for it reduces the coefficient of cost of distribution, and shortens the distance between us and our friends at home and abroad.

"This precious stone, set in a silver sea"—

this England of ours—is in the great front street of the world. Our coast line, in relation to our area and population, is the greatest in Europe; this natural advantage must be increased by the canalization of more rivers, for even for inland navigation canals are carrying goods at a cost of from one-tenth of a penny to one-hundred and sixteenth of a penny per ton per mile; at sea the cost varies from one-hundredth of a penny to one-six-hundredth of a penny per ton per mile.

Probably one of the most remarkable features in connection with the promotion of the Manchester Ship Canal was the enormous difficulty and cost of obtaining parliamentary powers, public enterprises in the past have had to fight similar battles.

Even the making of new roads from London to the agricultural districts was opposed, because it would interfere with the profits of the market gardeners of London. When the canals of the last century were promoted in Parliament, Mr. Philips, in his "History of Inland Navigation," published in 1795, quotes from one speech in favour of canals, that in order that the common carriers might not suffer, and have a chance of living, and not be entirely without employment, that an Act might be passed which would prevent canals going nearer than three miles to a large town; so that the common carriers could continue to conduct their business. When the first railways were introduced the vested interests of both the common carriers, by canal and road, stoutly opposed them, and the Manchester Ship Canal promoters in turn were opposed by the railways and the people of Liverpool.

Liverpool has been relentless in objecting to this great national enterprise. I daresay that not far short of £60,000 must have been spent by it in placing obstacles in our way.

Future history will show that instead of injuring the trade of the Mersey its importance will be increased. Goods from Liverpool will be sent at less than half the present cost to Manchester. The two great ports will create fresh markets for foreign commodities, and for general merchandise give a greater variety of boats at all seasons for every clime. Liverpool is thirty miles away from Manchester by rail; the cost of sending a ton from one to the other varies from 6s. 6d. to 8s.; but if this cost is reduced to two or three shillings, or even less, when used as a mere barge canal, I ask what parochial or hysterical method of unreason can call this an injury to Liverpool? The land between the two great cities will be the busiest of the earth, it will be a wharf over thirty miles long, and when the sun of commercial prosperity shines, it cannot light up Manchester without warming Liverpool.

For about three-quarters of a century the idea of a Manchester Ship Canal has been entertained. It seems very remarkable that the project should have remained so long undeveloped, as it has always been known, especially since the steamboat was invented, that goods could be carried for three thousand miles on water at a cost equal to thirty miles by rail. Water has no wear and tear. Every ton weight that goes over a road or railway creates destructive friction. The London and North-Western Railway people know how many tons a year lighter their rolling stock becomes through wear and tear, but water never shows old age.

"Time writes no wrinkles on thy azure brow
Such as Creation's dawn beheld thou rollest now."

If we carry double the weight on a canal it is not at double the expense. Every ton that goes over a railway destroys as much rail as any other ton; it is a definite fixed quantity well known to those who have to pay the cost.

The Manchester Ship Canal is thirty-five miles long. It commences in deep water at Eastham, on the Cheshire side of the river Mersey, which is about one and a half miles wide at this point, and is semi-tidal two-thirds of its entire length to Latchford, with the exception of about four miles the river Irwell is canalized to Manchester.

The minimum width of canal at bottom..........120 feet.
And the average width of canal at water-level... 172 „
The bottom width of canal between Barton and Manchester (two and a half miles) is increased to.. 170 „
Minimum depth .... 26 „
The Suez Canal is 75 ft. wide and 26 ft. deep.
The Amsterdam Canal is 88 ft. wide and 25 ft. deep.

Details of Locks in Canal.

Name of Locks.	Size of Large Lock.	Size of Intermediate Lock.	Size of Small Lock.	Number and size of sluices.	Fall.
	Ft. Ft.	Ft. Ft.	Ft. Ft.		Ft. In.
Eastham	600 x 80	350 x 50	150 x 30	2 Sluices, each 20 feet wide.	
Latchford	600 x 65	350 x 45	—	3 Sluices, each 30 feet wide.	16 6
Irlam	600 x 65	350 x 45	—	5 Sluices, each 30 feet wide.	16 0
Barton	600 x 65	350 x 45	—	4 Sluices, each 30 feet wide.	15 0
Mode Wheel ..	600 x 65	350 x 45	—	4 Sluices, each 30 feet wide.	13 0
Total fall from level of water in Manchester Docks to level of tide, rising 14 feet 2 inches above Old Dock Sill at Liverpool, this being the ordinary water level in canal between Eastham and Latchford					60 6

Dimensions of Subsidiary Locks.

Weston Marsh Lock ....229ft. long by 42ft. 8in. wide.
Weston Mersey Lock ...600ft. long by 45ft. 0in. wide.
Bridgewater Lock ......400ft. long by 45ft. 0in. wide.
Runcorn (Old Quay) Lock 250ft. long by 45ft. 0in. wide.

Manchester and Salford Docks.

Area of Water Space	114 acres.
Area of Quay Space	152 acres.
Length of Quays..................	5¼ miles.

LENGTH OF ARMS—SALFORD DOCKS.

North Branch	1350 feet.
Mid. Branch	1177 feet.
South Branch	828 feet.

LENGTH OF ARMS—MANCHESTER DOCKS.

Three Arms averaging..........	571 feet each.
Arm parallel to River	620 feet.

At a meeting of the Provisional Committee, formed a few years ago, to take into consideration the Manchester Ship Canal, Mr. Fulton's scheme was examined, which was that of a tidal canal: the difficulties connected with the navigation, the level at Manchester being sixty feet above the level of the Mersey, caused this scheme to be rejected.

Mr. Leader Williams' plan was adopted, which consists of making the entire length a series of ponds between the four locks at Latchford, Irlam, Barton, and Mode Wheel, which will lift up from the tidal way the vessels bound to Manchester. It must be borne in mind that the thousands of tons that will come up in the boats must be lifted up to the level, and as it has been pointed out by Mr. Williams, it will be a great deal cheaper to lift up these boats and goods by the natural fall of the water into the locks, than to use cranes at an enormous cost to lift the goods sixty feet to the level of the wharves.

The work of constructing the canal was entrusted to Mr. T. A. Walker, whose unfortunate death, closely followed by that of Mr. Daniel Adamson—both remarkable men—we have all looked upon as a great calamity; indeed it will never be possible to mention the Manchester Ship Canal without a feeling of gratitude and honour to the memory of these two great engineers.

There are forty-four millions of cubic yards of excavation of soil and rock to be removed in forty-eight months; up to the present time, satisfactory progress has been made, about thirty million cubic yards having been excavated.

There are ninety-seven steam navvies, with their huge buckets, taking out from the cuttings thousands of tons per day. On Thursday last, I saw the one at work between the Weaver and Ellesmere Port, and found that it was filling seven hundred and fifty waggons per day, each waggon carrying five tons, thus representing three thousand seven hundred and fifty tons for a day's work of twelve hours. At a reasonable calculation, one machine was doing the work of two thousand men. There are one hundred and sixty-nine locomotives, two hundred and forty-five steam cranes, one hundred and thirty portable and other steam engines, two hundred and eleven steam pumps, six thousand one hundred and sixty waggons, fifty-two pile driving engines, and the overland route of railway and sidings, two hundred and twenty miles long.

The steam power employed may be roughly estimated at about fifty thousand horse-power. There are one hundred and sixty-nine horses, and over twelve thousand men and boys. Ten thousand tons of coal and eight thousand tons of cement are used per month. The Manchester Ship Canal is in effect a continuous dock system, thirty-five miles long, taken from one end to the other. It is the nearest port accommodation for ocean steamers for a population of seven and a-half millions. Within six miles of the Manchester Exchange there is a population of one million; within twelve miles, a population of two millions; and within twenty-five miles, the largest population of the world, not excluding Pekin or London.

Mr. Bailey then proceeded, by means of dissolving views, to illustrate the works and cuttings, and took his audience past the Liverpool landing-stage, by the river Mersey to Eastham in the directors' barge, upon which were members of the Works Committee, of which the ex-Mayor of Oldham, Mr. Sam Platt, is chairman, his portrait being shown; one view giving an excellent likeness of Sir Joseph Lee, and also the ex-Mayor of Stockport, Mr. Joseph Leigh. He described the pumping station at Eastham, the various methods of excavating; the different steam navvies, and pile drivers at Ellesmere Port; the sea wall across the mouth of the Weaver, Weston Point Docks, Runcorn Bridge, Norton Sluices, Tom Paine's Bridge, at Warburton; Latchford Locks, methods of wheeling sand; buried trees and ancient timber found in the cuttings; wonderful geological formation at Warburton; the fossilized dead sea of Pseudomorphic Salt, Hollin's Green Ferry, Calamancer, and gave the origin of the name; Partington excavations, Sticken's Cut, the Old Well, Prehistoric boat discovered, and other geological, antiquarian, and archæological objects of interest along the Irwell; Barton aqueduct of Brindley's, finishing with the Manchester and Salford Docks, and other local views.

In conclusion, permit me to say that so far everything has gone well with this great public enterprise. We have twenty-one months in which to finish the canal, and we have faith that it will be completed according to contract. That the shareholders have unabated confidence in the scheme, we have clear proof in the fact, remarkable in the history of joint-stock companies, of the balance of the ordinary share capital of £140,000 having been subscribed for at par when the market price of the shares was at £2 discount. As one of the newspapers has said, "This action is a clear contribution on the part of the subscribers of £28,000 towards the successful completion of the canal."

The directors themselves, who, as you know, are largely and successfully engaged in the trade of the district, have subscribed a large amount of this money, and other large shareholders put their names down for the rest.

Manchester has a reputation. In "Coningsby," Disraeli says, "The age of ruins is past; have you been to Manchester." It seems but a natural sequence that in this birthplace of the last discovered law of force which declares the rate of exchange between heat and energy, in the city whose illustrious son, Dr. Joule, has taught mankind how to measure, weigh, and value heat and mechanical motion, that some consideration should have been given to the economics of trade, and to the removal of those obstacles which impede commercial progress.

In that great text-book of Adam Smith's, "An Enquiry into the Causes of the Wealth of Nations," he directed attention to the folly of expecting an increase of public prosperity, by making foreign commodities dear by force of law. The Manchester school accepted this wisdom, and the hall in Peter Street is a perpetual reminder that Manchester is also the birthplace of free trade.

"Civilisation is the economy of force," the perception and acceptance of this doctrine is a measure of intellectual progress. The men, and the sons of the men, who worked in past times for the removal of the restrictions on commerce, are the men who are making the Manchester Ship Canal.

LAUNCH OF THE "NORSEMAN," A NEW STEAM YACHT FOR MR. S. R. PLATT.

MESSRS. LAIRD BROTHERS launched from their works at Birkenhead on March 8th a very fine and strikingly handsome steam yacht, built to the order of Mr. S. R. Platt, of Oldham, from designs by Mr. St. Clare Byrne, of Liverpool, the well-known yacht designer. This is the second yacht built by the firm for Mr. Platt, and she was named the *Norseman* by Miss Platt, daughter of the owner, in the presence of Mr. and Mrs. Platt, Mr. and Mrs. Byrne, Colonel and Mrs. Platt, Mr. and Mrs. Walter Clark, and the Misses Clark, Miss Rowley, Mr. Oldham Rowley, Rev. A. Burr and Mrs. Burr, Rev. R. Ainslie and Mrs. Ainslie, Miss Fenton, etc.

The *Norseman* has been designed to combine good speed under steam, with first-rate sailing power when cruising under sail alone, and with that object has been fully rigged as a square-rigged schooner, spreading a large area of canvas, and fitted with a Bevis Patent Feathering Propeller.

She is built entirely of Siemens Martin steel up to the gunwale, with bulwarks. Deckhouse, companions, and indeed all deck fittings of teak, and is supplied with steam windlass, fire engine pump, screw cruising gear, etc., of the most modern and approved kind.

The boats are by Mr. J. S. White, of Cowes, and the sails by Messrs. Lapthorn & Ratsey.

Her dimensions are: Length over all, 152 ft. 6 in.; beam, 23 ft.; depth amidships, 13 ft. 6 in., with a tonnage of 327 O.M. She is fitted with bilge keels, which will very sensibly reduce her rolling when under steam.

Her machinery, which has been put on board on the stocks, and has been tested under steam, consists of a set of vertical triple-expansion engines, having cylinders 13 in., 19½ in., and 33 in. diameter, with 2 ft. stroke, working at 150 lbs. pressure, and capable of developing 350 I.H.P. The boiler is cylindrical, of steel, with two corrugated furnaces, crank shaft, pistons, and other parts of machinery of steel.

The arrangement of the cabins is somewhat similar to that in the old *Norseman* (Mr. Platt's previous yacht), the main saloon fitted in fumed mahogany, and the walls covered with rich and artistic material, being forward of the engine space, and forward of this are the main entrance from the upper deck, the pantries, lavatories, captain's, officers', and crew's quarters. The after-end of the vessel, which is reached by a corridor through one side of the engine room, and shut off by a watertight bulkhead furnished with watertight doors, contains seven staterooms (three or four of large size), beautifully fitted in various hard woods, and the walls richly draped.

On the upper deck amidships there is a large deckhouse built of finely mottled teak, which is quite a feature in the vessel, the fore part forming the companion way and smoking room, fitted in rosewood, and the after part the galley, from which a lift communicates with the saloon.

Immediately on leaving the stocks, the *Norseman* made a short trip on the river under steam, when the engines worked beautifully, and the vessel appeared to go at a high speed.

TRIPLE-EXPANSION ENGINES FOR H.M.S. "RUPERT."

THE *Rupert*, which was completed in July, 1874, is to be provided at Portsmouth with a set of triple-expansion engines to indicate 6,000 horses under forced draught (the same power as developed by her present engines when new) and 4,500 horses with natural draught, whereby her maximum speed will be increased by nearly a knot. These are the first set of engines of any importance which have been designed and constructed in the Portsmouth yard, and were undertaken with the purpose of securing continuity of employment and of promoting the study of marine engineering in the establishment. Hitherto the men employed in the steam department have been almost exclusively engaged in making good defects, which, instead of being spread over the whole year, are concentrated upon particular months. The work of the factory has consequently fluctuated between periods of great pressure and periods of comparative depression, so that the number of hands was continually varying. In order to remedy this undesirable state of affairs the Admiralty initiated a system of new construction to afford employment for the operatives during the dead season and between whiles. The innovation thus introduced necessitated the purchase of considerable additional expensive plant, including a couple of milling machines, a horizontal drilling machine, a double closing hydraulic riveting machine capable of exerting 150 tons pressure, a hydraulic machine for turning up flanges, and a remarkable machine for rolling and curving boiler-plates. The dockyard factory is now as well provided for manufacturing purposes as any private establishment in the country. In consequence of the interrupted character of the work, owing to the pressing claims of repairs, the construction of the *Rupert's* machinery has been greatly retarded, but at the present time the whole of the auxiliary engines are completed, while the main engines have almost reached the erection stage. The latter, which are of the vertical type, supported on steel pillars, will have a stroke of 4 ft., the high and intermediate cylinders being fitted with piston slides and the low-pressure with flat sides of the ordinary kind. The crank shafts, of which there are three to each engine, are made interchangeable, so that the necessity of carrying more than a single spare one is dispensed with. Steam will be supplied at 150 lbs. pressure by four double-ended and two single-ended boilers, which have also been manufactured on the premises. They are formed of steel, with steel tubes, and have each three corrugated furnaces at the ends, and the double-ended boilers are provided with an independent combustion chamber to each furnace. The condensers, of which there is one for each engine and also an auxiliary condenser, are made of cast iron, with brass tubes and tube plates. The tubes have an exterior diameter of five-eighths of an inch, and each of the main condensers contains about 3,000. The whole of the work, with the exception of the steel castings, has been executed in the yard. Next to the main engines the most important are some singularly beautiful and novel engines, which have been designed and constructed in the yard for driving the dynamos for producing the electric light. These are the first made, and are of an entirely new character. Two will be supplied to the *Rupert* and three for use in the yard. Instead of being boxed up, and consequently inaccessible, they are entirely open. They are of the compound tandem type, the high-pressure cylinder being placed on the top of the low-pressure cylinder. They are to be driven with steam at 100 lbs. pressure, and with 380 revolutions, which is considerably under the usual number, they are expected to indicate 65 horses, which is estimated to be equal to 400 ampères and 80 volts. The bearing surfaces are made large in order to remove all risks of heating, and to prevent all danger of fracture the exhaust pipe from the high to the low pressure cylinder is fitted with a gland which admits of a reasonable amount of expansion. Racing, caused by a number of lights being simultaneously switched out of gear, is prevented by spirally-fitted governors, by the sensitive action of which the revolutions cannot by any possibility leap up more than ten, after which, they almost instantaneously revert to the normal. Perfect lubrication, both as regards the steam in the cylinders and the moving parts of the engines, is effected by means of a common tank, and a number of separate copper pipes, without the use of the usual oil can. The main armament of the *Rupert* will remain unchanged, but the auxiliary armament will be increased by six quick-firing guns. The total cost of the refit is estimated at £300,767.

MR. THOMAS GRAY, C.B.

WE regret to announce that Mr. Thomas Gray, C.B., of the Board of Trade, died on Saturday, 15th March, at Rokesley House, Stockwell, at the age of 58.

Sir Thomas Farrer, writing to the *Times*, says:—"He was one of those men whose energy would have made a mark in any sphere of life, and who, if engaged in business, would probably have amassed a large fortune. He was the son of a poor man who gave his son something better than wealth—a strong character and a sound, practical education. He came into the Board of Trade about the year 1851 as a boy clerk at 15s. a week, was attached to the Marine Department, and won his spurs by making himself master of the business of surveying steamships, a branch of work to which he always remained much attached. There was something of genius in his rapid comprehension of mechanical problems, and his knowledge of ships and their machinery was as accurate and extensive as that of a shipbuilder or marine engineer. Few persons have such capacity as he had for making the technicalities of these subjects intelligible. The Duke of Richmond, when he came to the Board of Trade as President, used to say that after an hour with Mr. Gray he felt that he had been all the time in the inside of a ship. But he was not a mere specialist. In all subjects connected with the Mercantile Marine and with the welfare of seamen, in the abolition of crimping, in the improvement of officers, in wreck inquiries, in the commercial code of signals, in all the legislation and administration arising out of Mr. Plimsoll's move, he took a leading, helpful, and useful part. The rules of the road at sea he made almost his own, and his rhymes on that subject are as well known among seafaring men as 'Rule, Britannia,' and have been translated into all languages. Like all energetic men, he was fond of power, and sometimes overshot the mark; but he was always public-spirited, loyal, and invaluable to those who trusted him. He was insatiable of work, and drew too largely on his powers. His holidays were work in another form—rough voyages, exposed to hardships in search of practical information to be used in his official duties. His place brought him into inevitable contact—not infrequently collision—with shipowners, sailors, and engineers. But I believe there are few among them who will not join with me in recognising his devotion to the public service, his energy, and his very peculiar and unusual knowledge of the subjects with which he had to deal."

His funeral took place on Thursday, March 20th, at Norwood Cemetery, in the presence of his own family and a large and representative gathering of his colleagues and friends connected with the British Mercantile Marine, while expressions of regard were received from many unable to be present, including Mr. H. G. Calcraft, C.B., permanent secretary to the Board of Trade. The floral tributes were numerous and beautiful, one in the form of an anchor sent by the members of the staff of the Marine Department, Whitehall, being especially noticeable.

TRIAL TRIP OF THE TWIN-SCREW CABLE STEAMER "RELAY."

On March 8th this finely modelled steamer, built by Messrs. Robert Thompson & Sons, Southwick, and engined by Messrs. Clark, Limited, to the order of J. R. France, Esq., of London, had her official trial at sea for six consecutive hours. The vessel is destined for service on the cables of the Central and South American Telegraph Co., New York, and is of the following dimensions:—Length, 240 ft.; breadth, 32 ft. 2 in.; depth to ordinary floors, 24 ft.; built to Lloyd's 100 A1 class "awning deck." The water ballast is on the cellular principle, and divided so as to trim the vessel when laying the cable. The cables are held in three large circular tanks, and will be paid out over the stern sheaves, the bow being specially designed with three large sheaves for picking up the cables, and these being worked into the hull of the vessel form a graceful cutwater. The vessel being for hot climates, every care has been taken to ensure the most perfect ventilation and comfort of the passengers and crew on board. The decks are of iron and teak. Under the awning deck aft is the saloon, which extends right across the ship, the panelling being of Hungarian ash, rosewood, and mahogany, with fluted pilasters and neatly gilded caps and gold moulding, the ceiling being panelled white and gold. At the after part of saloon are the berths for captain, electricians, and chief engineer, baths, w.c.'s, &c. The pantry is fitted up with hot plate steam heater, also pneumatic bells in connection with all the berths, chart-house, and testing-room. Amidships is fitted up with berths for the officers, engineers, and cable hands, which are also of hard wood. The sailors' and firemen's berths are forward in the spacious forecastle. Forward of chart-room on awning deck is the testing-house, which has been fitted up with every care to prevent vibration, and immediately below on starboard side is in connection with the battery-room. On the main deck is the powerful picking-up and paying-out machine, driven by independent engines, and supplied by Messrs. Johnson & Phillips, of London. The dynamometers and leads for cables and steam sounding machine being on awning deck are also supplied by the same firm.

The deck machinery consists of steam capstan windlass, steam winches, and extra large donkey boiler and steam steering gear in house aft, and worked by control shafting on bridge. Two fresh water condensers are fitted, also a "Downton" pump to fill or empty each cable tank, in addition to filling or emptying by ballast donkey. She has six boats, each fitted with "Mills" disengaging gear. The bow and stern of lifeboats being fitted with sheaves for working the cable.

The engines, which have been built to both Lloyd's and Board of Trade survey, are of the triple-expansion type, and consist of two sets of engines, having cylinders 16½ in., 26½ in., 43½ in. by 30 in. stroke. They are placed right aft in the vessel, so that the cable tanks may be conveniently worked together. The starting platform, with telegraphs from the bridge and forecastle, is between the two engines.

The boilers are 160 lbs. working pressure, and are extra large to give ample steaming power.

Special arrangement has been made for circulating water in the boilers when getting up steam, or when the vessel is hove to on cable work to prevent injury to the boilers from unequal expansion of the plates, &c.

The propellers are of manganese bronze and are supplied by the company of that name.

The vessel left the port early on Saturday morning, and after adjusting the compasses had a run for six consecutive hours, full speed, which was for the whole time over 12 knots per hour. Everything worked satisfactorily, and being of the twin-screw type there was scarcely any vibration. During the trial, luncheon was served in the saloon, the following gentlemen being present:—Mr. J. E. Thompson, of the firm of R. Thompson & Sons, Mr. J. R. France (the owner), Mr. H. Clark, representing George Clark, Limited (builders of engines). Captain Lugar, who will take command, Mr. Rosser, inspector for the owner for both ship and machinery, Mr. Watt, Board of Trade surveyor, Mr. Hildrey, chief draughtsman to the builders, Mr. Cay, outside manager to engine builders, and a large party of friends.

STEAMSHIP "NORSEMAN."

NEW MAIL STEAMER FOR THE UNION STEAMSHIP Co.

On Saturday, March 22nd, Messrs. Day, Summers & Co., of Northam Iron Works, Southampton, launched a new steamer for the Union Steamship Co. The vessel is of the following dimensions:—

	ft.	in.
Length, between perpendiculars ..	230	0
Breadth	30	0
Depth, hold to main deck	14	8½

She has been built of steel to class 100 A1 at Lloyd's, under special survey, but the scantlings have been largely increased beyond Lloyd's requirements.

The vessel has been specially designed for the Union Steamship Co.'s trade between Southampton and Hamburg, and is fitted with every modern convenience for the comfort of a large number of first, second, and third-class passengers, and the speedy loading and discharging of cargo, and is fitted with water ballast in fore peak and main and after holds.

The poop deck, which is of teak, extends from forward of amidships to stern, and forms a long promenade deck, the boats being stowed on beams overhead, leaving the deck clear.

At the fore end there is a topgallant forecastle deck, which affords accommodation for the crew, and at the same time forms a house for the protection of the steam windlass and a platform for working the anchors, hawsers, &c.

The saloon, which is on the main deck forward of the machinery space, extends from side to side of the vessel, and is handsomely fitted up with tables and revolving chairs for thirty first-class passengers.

The walls of this saloon are tastefully decorated with ornamental carved work in various designs.

The first-class sleeping cabins are placed abaft of the saloon on the main deck, and are fitted with patent wire-woven spring folding-up berths and patent mahogany folding-up lavatories, which, while being exceedingly convenient, occupy the smallest amount of space. They are also fitted with electric light and electric bells, &c., &c.

The second-class saloon and sleeping cabins have been arranged abaft the machinery space on the main deck, the fittings of the sleeping cabins being identical with those of the first-class cabins.

The steering gear is Napier's patent combined steam and hand-steering gear, placed directly over the rudder-head. There are no chains or quadrant to give any trouble.

The steam gear is perfectly noiseless, while the hand gear is the most powerful that is made, the power increasing as the rudder goes over.

The windlass is Clarke, Chapman & Co.'s patent. The chain cables are in excess of Lloyd's requirements.

The steam winches, those of which are fitted, have also been supplied by Messrs. Clarke, Chapman & Co. They are of large and powerful make, capable of lifting heavy weights.

The ventilation of the ship has received special attention.

The vessel is being fitted throughout with electric light by Siemens Bros. & Co.

Particulars of Machinery.

The engines are on the triple-expansion principle, with three cranks, and are fitted with all the latest improvements.

The cylinders are 16½ in., 26 in., and 44 in. diameter, by 36 in. stroke; working pressure, 160 lbs. per square inch. The cylinders are fitted with liners, and steam jacketed.

The shafting throughout is of Vickers' steel, and extra large diameter.

The piston and connecting rods and all the forgings are of steel. The engines are fitted with steam reversing gear and steam turning gear, which can also be worked by hand.

The surface condenser has a cooling surface of 1,400 sq. ft. The air pump is worked by levers connected to after engine, and is fitted throughout with Beldam's corrugated valves.

There are two centrifugal circulating pumps, with separate engines, by Gwynne, each capable of supplying the condenser with the requisite quantity of water. These pumps are also arranged to draw water from the bilges of ship.

Three large and powerful donkey engines by Cameron are fitted in engine-room for feeding the boilers, pumping bilges, and for fire, sanitary and wash-deck purposes, also for filling and emptying the water ballast tanks.

Special provision is made for pumping out the bilges in every part of the vessel by the main and auxiliary engines.

The electric engine and dynamo is fitted in a recess in engine-room.

Engines are fitted with Weir's heater and distiller of the latest improved type.

The propeller is 13 ft. diameter, 14 ft. pitch, and 60 sq. ft. of surface, fitted with movable blades of Vickers' steel, sheathed with brass at tips.

There are two boilers, each 11 ft. diameter by 10 ft. long, built of steel, with two Fox's corrugated furnaces for a working pressnre of 160 lbs. per sq. in. The total heating surface is 2,000 sq. ft., and grate surface is 66 sq. ft.

There is also a donkey boiler 8 ft. diameter by 8 ft. 6in. long, built of steel, fitted with feed donkey &c., on the upper deck for supplying steam at 100 lbs. pressure to the winches, electric light, and auxiliary engines.

LAUNCH OF THE TORPEDO GUNBOAT "ALMIRANTE CONDEL."

MESSRS. LAIRD BROTHERS launched from their work on March 8th, the torpedo gunboat *Almirante Condel* for the Chilian Government, a sister vessel in every respect to the *Almirante Lynch*, which was launched from the same yard on the 8th ult., and of which we gave fnll particulars in our March number. These vessels are an enlarged edition of the well-known *Rattlesnake* of our own Navy, and it is expected by their designers and builders that they will prove themselves as great a success as that vessel has done.

They have a length over all of 240 ft., with 27 ft. 6 in. beam, and a maximnm draft of 9 ft. to 10 ft. They will be fitted with two pairs of triple-expansion surface-condensing engines, with four boilers of the locomotive type, and when working under forced draught will be capable of exerting 4,500 horse power, with which a speed of 21 knots is expected. The armament will consist of Hotchkiss, three 14-pounder, and four 3-pounder quick-firing guns, two of the former being arranged on the forecastle so that they both fire right ahead, the third on the poop at the aft end, commanding a range right round the stern, as well as two five-barrelled Gatling guns placed in a commanding position on the top of the pilot tower. The torpedo armament consists of five torpedo guns, one fixed in the bow, and the other four on the broadside, arranged round a considerable angle of training.

Good freeboard at the ends, very essential in this class of vessel when being driven fast in a seaway, and a high platform for the bow and stern guns, is secured by topgallant forecastle and half-poop, which also increases the space available for accommodation; this, both for officers and men, will be ample. The vessel is fitted throughout with electric light, and will also have a powerful 25,000 c. p. search light.

The *Almirante Condel* was christened by Miss Brownell, the ceremony taking place in the presence of Admiral Latorre, of the Chilian navy, Mr. T. Cockbain, Chilian Consul, Mr. and Mrs. Brownell, Captain Fernandez, and the resident superintendent of the work, Senors Astorga and Olivares of the Chilian navy, Colonel Spurr, Colonel Cabaesa, Captain Scott Brown, Captain Betbeder, and other officers of the Argentine navy, Senor and Senora Ibarra, etc.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual session of this institution was opened on Wednesday, March 26th, at the Society of Arts, Adelphi, Lord Ravensworth presiding. There were present Sir E. J. Reed, M.P., Mr. W. H. White (the Assistant Controller of the Royal Navy and Director of Naval Construction), Admiral Sir John Hay, Admiral de Horsey, Admiral Colomb, Admiral Lord Clanwilliam, Admiral Boys, Admiral Sir George Willes, Sir Frederick Bramwell, Admiral Mayne, Mr. Carbutt, Admiral Morant, Mr. J. W. Biles, Mr. F. Elgar, Mr. Yarrow, Mr. Thornycroft, and a good attendance of members connected with the royal and mercantile navies.

Mr. George Holmes, the secretary, read the annual report, which stated that the position of the institution was of a satisfactory character financially and otherwise.

The President, in moving the adoption of the report, spoke of the loss sustained by the institution from the deaths of Sir Spencer Robinson and Mr. Thomas Gray, late of the Board of Trade. The year had been marked by great activity in the shipbuilding trades, great production, and moderate profits. There had been turned out 1,286,000 tons of shipping in the course of the year, of the value of £20,000,000, and the remarkablo difference between the shipbuilding of last year and that of 1883—another busy year—was, that while in 1883 the ships built was only 15 per cent. of steel, last year 92 per cent. of the tonnage was built of steel and only eight of iron. Moreover, the ships built last year were for regular lines and special trades, and their construction showed that strength and great steam power were characteristics of the merchant vessels of the present day. The increase of price of material and labour had caused fresh orders to become scarce. Indeed, there were scarcely any new orders at all, and the work now in the yards of the country was from last year's orders, which had kept the yards busy in January and February of this year. He expressed the hope that the workers and the employers would find some means of abolishing strikes, which broke down the confidence of employers, and the lack of confidence would cause workers to lose the advantage of constant wages. As to the Load Line Bill, he expressed his strong objection to legislation of a compulsory character. Such legislation was not required for the best shipowners; and the owners of other than the best ships could evade such laws, and moreover, such laws could not be enforced against foreign ships.

The report was adopted.

Mr. W. H. White, F.R.S., Director of Naval Construction, read the first paper, which was entitled "Notes on Recent Naval Manœuvres," the full text of which, as well as the discussion thereon, will be found at p. 2 of this number.

THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.

A Paper recently read before the Institute of Marine Engineers, by ASPLAN BELDAM, Esq., *President of the Institute.*

IN October, 1788, there appeared (it is said) in various Scotch newspapers, an account of an experiment which was said to be "no less curious than new." It was stated that, on the 14th inst., a boat was put in motion by a steam-engine, at Dalswinton, by Mr. Miller, on a piece of water at that place. It was also said "that that gentleman for some time past had studied the application of the 'steam-engine' to the purposes of navigation." He accomplished and eventually showed to the world the practicability of this by executing it on a small scale.

A vessel 25 ft. long and 7 ft. broad was, on the above date, driven with two wheels by a small engine.

It is said, moreover, that it answered Mr. Miller's expectations, and afforded great pleasure to the spectators present. The engine used was Mr. Symington's, and was patented by him.

It was also stated that "a more complete and beautiful experiment was never made by *any* man, at *any* time, either in art or science." The vessel moved delightfully, and, notwithstanding the smallness of the cylinders (4 in. in diameter), went at the rate of five miles an hour.

It continued to ply for some days for the amusement of the projector, and to the astonishment of the country people, who assembled from all quarters to witness the wonders of a "boat driven by reek." Fifty years later (that is in 1838) the *Sirius* and the *Great Western* crossed the Atlantic, both arriving at New York on the same day, April 23rd, the *Sirius* in the morning and the *Great Western* in the afternoon.

The credit for the design of the engine and boat used at Dalswinton seems to be conjointly due to Patrick Miller, James Taylor, and William Symington.

John Scott Russell has remarked—"The creation of the steamship appears to have been an achievement too gigantic for any single man. It was produced by one of those happy combinations in which individuals are but tools; each working out his own part in a great system, the whole of which no single one may have comprehended all the workings." And he came to the conclusion that the art of steam navigation was the joint invention of the three men I have already named, and that to their efforts the world owes its present advantages.

The second steamboat was constructed at Carron, in 1789, by the same three men; it was 60 ft. in length, and was fitted with engines having cylinders 18 in. in diameter. It is said a speed of nearly seven miles an hour was obtained.

The first really practical steamboat (the *Charlotte Dundas*) was designed by Symington in 1801, and tried on the Forth and Clyde Canal early in 1802. It was propelled by an engine designed and patented by Symington. It was a horizontal direct-acting engine, and appears to have been the first ever made, the piston and connecting rods of which were coupled direct to the crank arm, the lever being dispensed with. It is said this vessel was able to tow two vessels (each of 70 tons burthen) a distance of 20 miles (against a strong head-wind) in six hours. The proprietors of the canal, fearing injury to its banks, declined to adopt the new system of towing; and hence we hear nothing further (to my knowledge) having been done by Symington.

We have now to cross the Atlantic for the next development of the marine engine. John Fitch, an ingenious Connecticut mechanic, for many years experimented with different designs of engines, and from 1787 till the time of his death, in 1798, built several steamboats, but in all his attempts he was unfortunate.

Various other workers were busy in America about the same time or shortly after. Most prominent amongst them was Robert Fulton, who (although American by birth, was Irish by parentage) at the early age of twenty-one, by his own exertions, had acquired considerable skill in mechanics and as an artist. Coming to England in 1786, he spent some time in mechanical pursuits, and arriving (as he did) just before the trials of the Dalswinton and Carron boats, his attention was naturally directed to them, and about which he collected a considerable amount of information. After spending some years in England he migrated to Paris, where many projects occupied his time, such as submarine warfare, locomotion, and explosions.

In 1801 he directed the attention of Livingstone (the American Minister at the Court of France, who had himself made many experiments on the subject) to the importance of steam power in navigating the lakes and rivers of their own country, and the two agreed to co-operate. Fulton went to work in a thorough manner, and made experiments on the resistance of models of different kinds at various speeds, and guided by these results, completed a steamboat, which was tried on the river Seine, in 1803, but the vessel being too weak for the heavy machinery, broke in two and sank to the bottom of the river. The machinery, however, was little injured, and the hull being reconstructed, a trial was made later in the same year, and a speed of 4½ miles an hour attained.

Disappointed in obtaining pecuniary aid from the French Government, he crossed to England in 1804, and ordered an engine from Boulton and Watt, of 2 ft. diameter of cylinder, and 4 ft. stroke, which in design was a modification of the ordinary type of engine made by that firm.

Fulton and Livingstone, on their return to America, constructed a vessel called the *Clermont* (which was launched early in 1807) and employed the Watt engine to propel it. This vessel was larger than any other hitherto constructed; being 133 ft. long, 18 ft. broad, and 9 ft. deep. This vessel on its trial ran a distance of 150 miles in thirty-two hours, and returned in thirty hours. This, no doubt, was the first voyage of considerable length ever made by a steam vessel.

After the success of the *Clermont* Fulton built a number of other vessels; and in 1812 he designed the first steam vessel of war, which was launched in October, 1814. The *Fulton the First* (as the vessel was called) was considered of enormous dimensions at that time. The hull was double; her dimensions 156 ft. long, 56 ft. broad, and 20 ft. deep, and measuring 2,475 tons. On her trial trip she steamed 58 miles in 8 hours and 20 minutes; and when her armament and stores were on board, made 5½ miles an hour.

Fulton's name deserves to be honoured, for having done so much in advancing marine engineering, and making steam navigation a commercial success.

Among other Americans who did much to promote marine engineering in its early days, I must mention John Stevens, of Hoboken, who not only much improved the designs of engines, boilers, and propellers, but also the form of vessels, and his son Robert L. Stevens, afterwards known as the designer of Stevens' battery.

Henry Bell, of Helensburgh on the Clyde, having occupied his mind on the work of Fulton and Livingstone in America, now turned to useful account his experience of Miller, Taylor, and Symington, and had the good fortune to associate himself with an able shipbuilder and ingenious engineer. In 1812 he contracted with John Wood, of Port Glasgow, to build the hull, and with John Robertson, of Glasgow, to make the engines of the *Comet*. This vessel was 42 ft. long, 11 ft. broad, and 5 ft. 6 in. deep. The engine had a cylinder 11 in. in diameter with a stroke of 16 in. At first she was fitted with two pairs of paddles driven by spur-gearing; but this arrangement proving unsatisfactory, she was lengthened to 60 ft., and fitted with a single engine, which drove a single pair of paddles. The speed attained appears to have been about six miles an hour. Mr. Bell had associated with him in his experiments, John Thompson, a Glasgow engineer, who (feeling himself aggrieved) got Mr. John Wood to build a vessel 51 ft. long, 12 ft. beam, and 5 ft. deep, which was named the *Elizabeth*, and made an average speed of nine miles an hour, and thus was enabled to eclipse Bell's *Comet*. The *Elizabeth* was, therefore, the first remunerative steam vessel in Britain.

Among the early shipbuilders, are the names of Wood, Steel, Scott, Denny, and Caird, and engineers, those of David and Robert Napier (of the Clyde) stand pre-eminent. Mr. Scott Russell was of opinion that from the year 1818 till about the year 1830, David Napier effected more improvements in steam navigation than any *other* man.

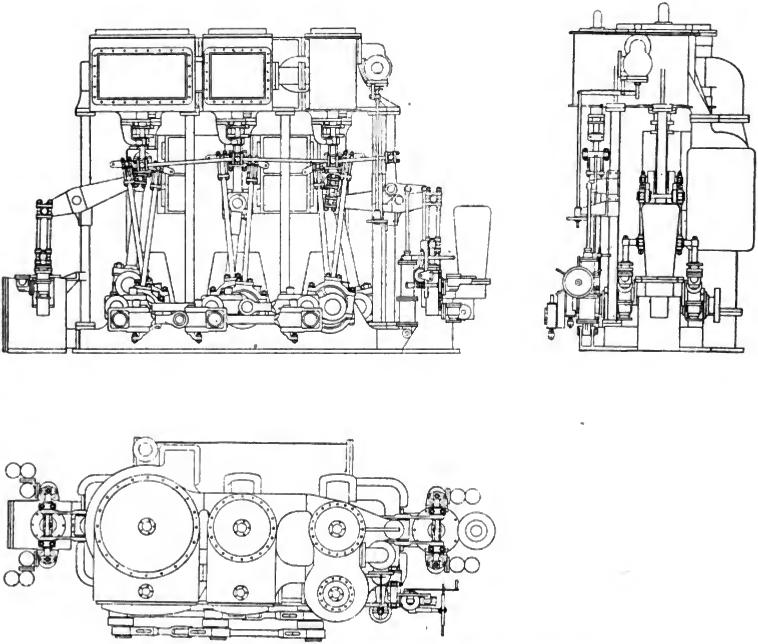
The *Robert Bruce*, of 150 tons, built by Messrs. Wood, the *Superb*, of 240 tons; and the *Eclipse*, of 140 tons, were all engined by David Napier, and their good construction did much to establish steam navigation, and render it an object of national importance. These vessels were built from 1818 to 1820. The construction of the *James Watt*, in 1822, was a decided step in advance. She measured 448 tons, and was built by the Messrs. Wood. In form, strength of construction, and speed, she was much before every vessel of her day, having a speed of 10 miles an hour. Her two engines of 50 H.P. were by Boulton and Watt, and were geared between the crank and paddle shafts. From the time of the construction of the *James Watt* a gradual increase in the size, and improvement in the design of the ships and engines took place, until what was called at the time the "Leviathan class." An American vessel, the *Savannah*, partly sailing and partly steaming, crossed over to Britain in 1819, and in 1833 the *Royal William* crossed from Quebec; but it was in the year 1838 that Transatlantic navigation was established on such a basis as to prove that it would be commercially successful. The voyages of the *Sirius* and the *Great Western* had already proved this. The *Sirius* was built in 1837 by Messrs. Menzies, of Leith, and the engines (which were of the side-lever type) were constructed by Wingate & Co., Glasgow, her tonnage being about 700 tons, and her H.P. 250. The *Great Western* was the first steamship specially constructed for the Atlantic trade. She was built at Bristol, by Mr. Paterson, her dimensions being 212 ft. long, 35 ft. 4 in. broad, and 23 ft. 2 in. deep, and registering 1,340 tons, builder's measurement. Her engines (which were side-lever, and 440 H.P.) were constructed by Maudsley, Sons & Field, of London, having cylinders 73½ in. diameter, and 7 ft. stroke, making 12 to 15 revolutions per minute. The *Sirius* and the *Great Western* arrived in New York on the same day, April 23rd, 1838, the latter having performed the voyage in four days less than the former.

For the next twenty years the side-lever engine was employed almost entirely in the large mail packet companies, and was essentially Watts' engine modified in certain details. The Americans used (and still use) the ordinary "beam engine" for paddle steamers, but in Britain, in order to economize space, and bring the weights low down in the vessel, they were inverted, and thus became what were called "side-lever engines." Some of these engines were of magnificent design; but they were by no means self-contained, the kelsons and framing of the vessels being largely relied upon for resisting the stress arising from the action of the engines; and this being the case, a low pressure of steam and uniformity of motion were matters essential to their safe working. The pressure of steam was generally from 3lb. to 5lb., and seldom exceeded 10lb. on the square inch above the atmosphere, whilst the space occupied by machinery was enormous. I believe that the consumption of coal at this period was about 7lb. per I.H.P. per hour.

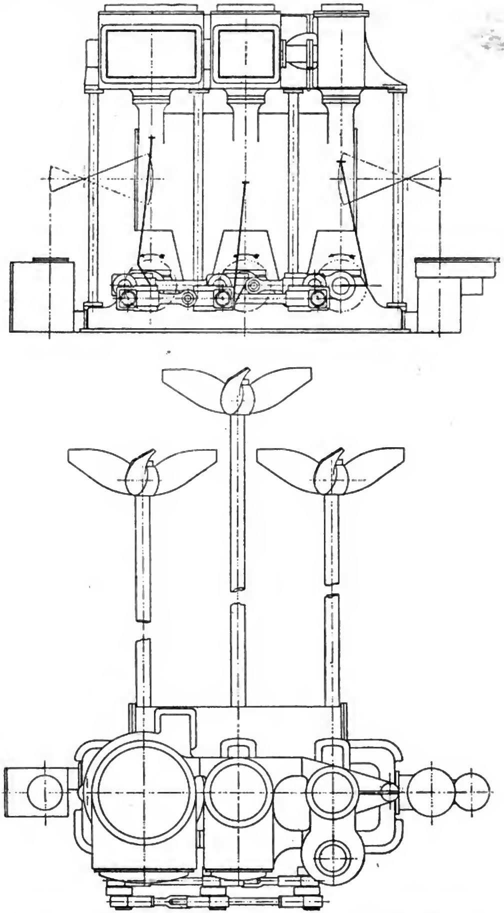
The steeple-engine designed by David Napier soon became the favourite engine for driving paddle steamers, and continued to be used for many years, especially in river steamers, and also the direct-acting diagonal or oscillating engine (a well-known type) designed, I believe, by Joseph Maudsley, about 1827.

(To be continued.)

Proposed Re-starting of Scotswood Shipyard.—Acting on behalf of the owners, Messrs. Snowball & Co. have disposed of the Scotswood Shipyard as a going concern. It is understood that the new occupants have made arrangements to commence work at once, and that a large number of hands will be employed.



TRIPLE-SCREW TRIPLE-EXPANSION ENGINES (Dunsmuir's Patent.) 1200 I.H.P.
Scale · · · ¼ inch to 1 foot. *For Description, see pages 22—24.*

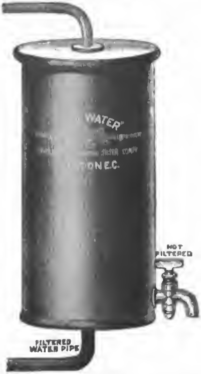


TRIPLE-EXPANSION TRIPLE-SCREW ENGINES (Dunsmuir's Patent.) 1200 I.H.P.

Scale - - - - ¼ inch to 1 foot. *For Description, see pages 22—24.*

SELF-CLEANSING UNBREAKABLE FILTERS.

THE importance of a continuous supply of good water to those "who go down to sea in ships," and more especially to those passing through tropical climates, cannot be over-estimated. It is acknowledged that pure water is one of the essentials of perfect health, and impure water one of the most prolific sources of disease, and any invention which will give guaranteed pure water to those at sea should be hailed as an unqualified blessing.



Such is the filter of which we here give an illustration. The water from it is pure and sweet, the supply is continuous, and ample for both passengers and crew, a matter of the highest importance, as the latter are often unfit for duty from illness, alone brought on by drinking water charged with all manner of impurities. It has been specially made for use on board ship, and is strong and unbreakable. It can be fitted in any part of the ship, and the filtered water either drawn from it direct or led from it to the saloon, cabins, pantry, or elsewhere as required. The one we illustrate is fixed in the ship's pantry, and the water to be filtered enters by the pipe at the top, and after passing through the filtering material it is led through the pipe at the bottom to the saloon, a distance of perhaps a 100 feet, or elsewhere, as may be required. The tap at the side serves a double purpose. Unfiltered water can be drawn from it for washing up and other purposes, while the mere act of drawing off through this tap thoroughly scours and cleanses the interior of the filter, removing all impurities left on the filtering medium. It purifies and sweetens condensed water, and is specially adapted for use on passenger steamers, emigrant, troop, and cattle ships, and can be made to filter from 10 to 100 gallons and upwards per hour, and should be found as part of the equipment of every sea-going vessel.

Filters of this self-cleansing unbreakable description have been supplied to the Orient Line, Pacific Line, British India Steam Navigation Co., &c., &c., some of which have been in constant use for nearly four years and have given the greatest satisfaction and have proved themselves to be, we believe, the cheapest and most serviceable filters yet introduced to the shipping community. They can be seen at work at the premises of the makers, The Universal Self-Cleansing Filter Co., 108, Fenchurch Street, London, E.C.

DUNSMUIR'S PATENT MULTIPLE SCREW ENGINES.

STEAMSHIP propulsion by twin-screws has, as is well known, come largely into favour during recent years in the case of ships of large size and high speed, for both warlike and mercantile purposes. The adoption of twin-screws in point of fact is almost an absolute necessity imposed by the growth in size and power of typical modern ships. The question of superior propulsive efficiency, however, is by no means a settled point, but even in this respect, the experience gained in practice has been less adverse to the twin system than was generally anticipated it would be. The clearly established advantages of twin-screws are such, however, as render acceptance of the system on the part of naval designers and the owners of full-powered passenger vessels much more natural than acceptance on the part of the owners of cargo or semi-cargo and passenger-carrying vessels. These advantages consist in the absence of risk of total disablement of the propelling apparatus (as with either screw at work a twin-screw ship is not merely under control, but able to make good headway) in general handiness; and in greater manœuvring efficiency, especially in the case of serious damage to the rudder or steering gear. The duplication of engines and propellers also enables the watertight subdivision of the engine-room to be increased; a matter of the first moment, both in war-ships and large passenger-carrying vessels.

On the other hand the disadvantages attaching to twin-screws have engendered a prejudice, which, if not always quite warranted, has, hitherto at least, been quite natural—especially in the case of owners of purely cargo or semi-cargo and passenger vessels, which, of course, have to do service on strictly commercial lines. The necessity for duplicate sets of engines, with all their complicated details, extra first cost, extra engine-room staff, more expensive upkeep, and extra space taken up in the vessel, are considerations which have hitherto stood in the way of the adoption of twin-screws. These same considerations have even induced owners to adhere to the single screw in numerous cases of broad, shallow vessels, where twin-screws would have been found greatly more to their advantage and economy. Twin-screws, moreover, are more liable to damage than single screws, when ships are going into or leaving docks, coming alongside wharves, or taking the ground.

Of these several considerations, it will be gathered that the principal ones partake more of a commercial than of a technical character (*e.g.*, extra first-cost, extra weight carried, extra attention, and extra space required), and it is matter of gratification to us to be able to illustrate, herewith, an ingenious arrangement —the subject of letters patent—whereby Mr. Hugh Dunsmuir, of Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow, may claim the enviable distinction of having removed the obstacles in question. Our illustrations show an arrangement for working multiple—two, three, four, or more—screw propellers, by means of one set of direct-acting engines, placed crosswise in the vessel to be propelled. The principle of this invention consists in placing one set of engines or cylinders athwartship in the vessel, instead of fore and aft as usual, and making each cylinder drive its own shaft and propeller direct. The crank shafts under the several cylinders are effectually joined together by side connecting rods, cranks or discs, in a somewhat similar manner to the side connecting rods of a locomotive engine, thus combining the two, three, or four cylinders or engines into one, and thereby producing all the benefits due to the number of cylinders and the ratios of expansion, with cranks set at equal angles, and at the same time giving choice to adopt twin-screw, triple-screw, or quadruple-screw propellers as may be most suitable to the type of vessel.

Engines, as here described and illustrated, can be fitted with the same facility, and nearly at the same cost as an ordinary set of single screw engines, and the attendance need not be increased. Other advantages, apart always from the debatable one of increased direct propulsive efficiency, are:—The cylinders being designed to produce equal powers, there will, in ordinary working, be comparatively little strain on the side rods, except, probably, when starting or reversing the engines, or in event of a propeller or shaft being carried away or broken; when, of course, the engine of the disabled propeller or shaft will assist the other engines through these side connecting rods. Thus, a steamer fitted with, say, three screw propellers and sets of shafting will have so many more chances in her favour at sea than a steamer with only one propeller. There is also less chance of small propellers and shafting being broken than large ones. Moreover, as all the propellers will be right or left-handed, one spare propeller will suit any shaft. All the propellers being connected and working simultaneously, there will be less tendency of these engines to race when the vessel is rolling; and, for the same reason, there can be no dragging of one propeller on the other, as in the case where one engine is going faster than its neighbour. Being placed athwartship, these engines will occupy about a half less room in the vessel than if placed fore and aft. The slide valves can be placed on the forward or after side of cylinders as desired, and worked direct off the shafts with the usual link motion. The condenser, pumps, and other arrangements of these engines can of course be varied to suit the particular ideas of purchasers. The crank shafts being about a third of the usual length, and with only two bearings, will not be injured so easily by wearing out of line, or by the fore-and-aft straining of the vessel, as where one continuous shaft is bound by six close bearings, and the engines and shafting can be very conveniently overhauled and adjusted.

To return to the question of direct propulsive efficiency. Our naval authorities have already found, from repeated trials during the last few years, that two small screws are more generally efficient than one of large diameter having equal surface. Exhaustive experiments, made during 1885, by the Council of Construction of the French Marine at the instigation and under the guidance of Monsieur L. de Bussy, the Inspecteur-Général du Génie Maritime, showed that, with vessels of a suitable form, even three screws are, from the point of view of speed, very nearly equivalent to two screws of the same propulsive surface, and immersed to the same depth, when the most favourable position is chosen for each system. For a vessel of similar form to the one experimented with, it was also found that results were most satisfactory from the employment of a system of three screws (placed, one in the centre line of vessel forward of rudder, and one on each side, some distance in advance of the centre one) having a ratio of pitch to diameter, differing but little from that ordinarily in use for vessels having single or twin-screws. A most interesting circumstance connected with the use of three screws, also discovered by these trials, lay in the fact that of all positions which were tested those which are best sheltered by the hull are also most favourable to speed, and have greater advantages for navigation and fighting purposes than the twin-screw arrangement. It was also found from these experiments that the vessel steered better with three propellers than with two.

Owners of large passenger vessels, as already indicated, are finding it safe and no less efficient and profitable to adopt twin-screws; and owners, generally, will doubtless soon find it profitable, in all essentials, to adopt two or three small screws, driven by the Dunsmuir engine, and well immersed in solid water at all draughts, than one of large diameter with its top blade working half out of water when in ballast trim or half loaded, thus greatly destroying its own efficiency by sucking down air and wasting engine power. Screw-propellers have been greatly reduced in diameter since it was first shown by the late Dr. Froude how enormously their peripheral friction is increased and engine power used up by increasing their diameter, and the knowledge of this within the last year or two has been most beneficial in numerous instances. There is, of course, a limit to the reduction of diameter with only one propeller, seeing that enough surface must be left to propel the vessel; but with twin-screws the diameter can be greatly reduced, and with triple-screws the requisite propelling surface can be got by smaller diameters still. Moreover, two, three, or four small propellers, working in solid water, and having nearly equal pressures on their revolving blades, will propel the vessel with less deviation from a straight course with helm amidships than one large propeller necessarily working in water of varying densities.

To sum up. In addition to the benefit of being able to work multiple screw propellers by one set of direct-acting engines, and thereby saving the large cost of duplicating and triplicating the machinery, there is the enormous saving of room in the vessel, much less weight to carry, greatly less tear and wear, more economy of steam, oil, &c., and less labour to attendants. It also follows that the adoption of smaller screws results in more revolutions, more piston speed, more relative power, shorter strokes, lower and lighter engines, and more efficiency in the engines as well as in the propellers.

Altogether, the arrangement we herewith illustrate gives greater freedom to shipbuilders and shipowners in designing their vessels, as regards draught, speed, and economical propulsion. Messrs. Dunsmuir & Jackson, we understand, are about to fit triple-expansion engines of this type, driving three screws, into a vessel of 80 ft. in length by 20 ft. in breadth; and a second vessel of 120 ft. in length will be proceeded with immediately the results attending the first vessel are known. There is, in our opinion, a bright future for propulsion by multiple screws, driven by this patent arrangement of marine engine; especially in vessels of large power, and those intended for service where it is absolutely imperative to minimise the draught.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from February 26th to March 24th, 1890:—

Barry, Geo. W., chief engineer to the *Sandfly*, reappointed on promotion, to date February 27th.

Carey, Jno. J., engineer to the *Redbreast*.

Cooke, George H., chief engineer to the *Pallas*, to date March 5th.

Denbow, Wm., assistant engineer to the *Shannon*, to date March 5th.

Gyles, David J., staff engineer to the *Inconstant*, to date March 18th.

Harding, Wm. J., staff engineer to the *Asia*, additional, to date March 5th.

Haves, Ernest, probationary assistant engineer to the *Euphrates*, to date March 4th.

Lee, Richard S., fleet engineer to the *Hector*, to date March 5th.

Lemon, John A., staff engineer to the *Raleigh*, to date March 18th.

Morris, Thomas A., chief engineer to the *Thames*, to date March 18th.

Richards, John A., assistant engineer to the *Persian*, to date March 5th.

Williams, Walter K., engineer to the *Blanche*, to date March 4th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, March 24th, 1890.

Teak.—The stock has been increased by the arrival of one cargo from Moulmein and three from Bangkok.

The demand is dull and the quantity required for shipbuilding purposes has not reached the total expected. The consumption, however, through other channels is good, and the deliveries during the first three weeks of the month show the following satisfactory figures.

	Timber.	Planks.	Blocks.	Total.
Stock, 28th Feb.	9,884 Lds.	1,501 Lds.	38 Lds.	11,423 Lds.
Landings	nil. ,,	395 ,,	2 ,,	397 ,,
	9,884 ,,	1,896 ,,	40 ,,	11,820 ,,
Deliveries	562 ,,	109 ,,	6 ,,	677 ,,
Stock, 21st Mar.	9,322 ,,	1,787 ,,	34 ,,	11,143 ,,

These figures do not include the cargoes now discharging.

Mahogany.—Trade during the month has been of a restricted character on account of the stock having been so much reduced. Prices are likely to continue firm, and it is fully anticipated that the new arrivals will find a ready market.

Cedar.—A small demand prevails, but stocks are not large and holders are firm with prices.

American Walnut.—The market is fairly lively and prices of prime logs remain good. Consignments of first quality stuff would sell well.

The importation of Lumber has been very considerable and prime quality boards and planks in large parcels have changed hands at lower prices than usual.

American Oak.—There is no change in this wood, and a fair demand continues at low rates.

Sequoia is seldom asked for now, and appears to be losing the reputation it has hitherto held.

Greenheart still remains inactive, and there is nothing to report.

The stock is 66 loads.

General business has fallen off considerably and the prospect all round cannot be considered encouraging.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE present is indeed "the day of small things" on the Clyde in the matter of fresh orders for ships, and there is quite an evident desire not to despise the same on the part of builders. For four or five weeks past only some four or five separate orders have been recorded as booked, and most of these are for "small fry," such as attract no attention in brisker times. Mr. T. B. Seath & Co., of Rutherglen, have received an order for four electric launches, through Messrs. Morton & Williamson, acting, it is understood, on behalf of the Electric Traction Co., London. These launches are intended for service on the Seine, and the Electric Traction Co. will themselves supply the electric apparatus for their propulsion. Messrs. McAllister & Son, Dumbarton, are to build for Borthwick & Co., Glasgow, a fast steam launch, 45 ft. in length, and Messrs. Murdoch & Murray, Port-Glasgow, have contracted to build two screw steamers of 175 ft. length of keel. Messrs. Kincaid & Co., engineers, Greenock, have also contracted to build a steel twin-screw steamer of 700 tons register, for passenger and cargo traffic on the River Plate, South America. The machinery and engines will be made by Messrs. Kincaid & Co., while Messrs. Russell & Co., also of Port Glasgow, will construct the hull.

Messrs. A. & J. Stewart and Clydesdale is a new limited company, just formed for the purpose of carrying out an amalgamation of the businesses of Andrew and James Stewart (Limited), iron and steel tube manufacturers, and iron founders of Coatbridge and Glasgow; Messrs. Stewart Bros., iron and steel tube manufacturers, of the British Tube Works, Coatbridge; and the Clydesdale Iron and Steel Co., iron and steel manufacturers, of Mossend, near Glasgow. The works of Messrs. A. & J. Stewart include the Clyde Tube Works, the Sun Tube Works, and the Clyde Pipe Foundry. These with their accessories cover some 14 acres of ground, and employ about 1,200 workmen. The manufactures consist of marine and locomotive boiler tubes, steam, water, gas, oil, and artesian well tubes and other kinds of fittings. The British Tube Works are of recent establishment, and are also admirably situated for manufacture and output, while the Clydesdale Co. bring into the new venture a fully-equipped plant for the manufacture of malleable iron and steel. Already their works cover over ten acres, and the feu permits of extension to twenty-one acres, an ample margin for the anticipated increase of business. The combined businesses will form the most extensive tube manufactory in Great Britain. All the above works are situated in the heart of the Lanarkshire coalfields, and of the great iron and steel producing districts, and materials are obtained with facility and economy. The combined works, which are within easy distance of each other, will occupy about forty acres of land and employ upwards of 2,000 hands.

Messrs. Haythorn & Stuart, of Eastwood Works, in the Pollokshaws district of Glasgow, have for some considerable time past been busily remodelling their extensive premises, primarily with the view of manufacturing the various marine engine specialities with which the name of Mr. Haythorn is associated as patentee. The works are now in proper order for undertaking this and other larger branches of engineering, entirely new plant having been laid down throughout the various shops. The firm is at present supplying most of the plant for the new steel works at Dumbarton, and the resources of their establishment are now beginning to be drawn upon for Haythorn's patent piston rings and springs, amongst the patrons of this type of packing being Messrs. Denny & Co., of Dumbarton, Messrs. Simons & Co., of Renfrew, and Burrell & Sons, of Glasgow. Haythorn's patent piston valve packing, now extensively adopted by leading engineers, and his patent metallic rod and plunger packing, specially adapted for high pressure, are at present also in demand. What with these and other important specialities yet to be developed, the firm have every prospect of a successful career.

Messrs. Dunsmuir & Jackson, Govan Engine Works, like the Fairfield Co., have recently been adding to their premises. They have just completed a splendid new erecting shop and are presently adding to their establishment handsome suites of offices, which when completed will not only be striking erections as regards exterior, but will add immensely to the facility and comfort with which contracts will be pushed forward in their already extensive works. The work on hand is sufficient to keep their numerous hands employed for many months to come.

The Ailsa Shipbuilding Co., of Troon, who some considerable time ago secured the contract for four steamers of about 250 ft. in length from the British India Steam Navigation Co., and have since had two repeat orders, are busily discharging their important undertaking. The fourth vessel of the series was launched on the 22nd inst., and the third, the *Kasara*, is nearing completion at the Clydeview Crane, near the works of Messrs. Dunsmuir & Jackson, Govan, whose engines are being fitted into all the vessels. From a personal inspection of the vessel named we are enabled to answer for the beauty of design and the high-class character of the workmanship both in structure and outfit. A previous vessel of the same class, the *Kisna*, had the honour of conveying Prince George of Wales across the Indian Ocean on his recent Eastern tour, and the company have since received private testimony from India that the accommodation and fittings of the vessel had given the Prince the utmost satisfaction.

Messrs. John Cran & Co., of Albert Engine Works, Leith, are as usual extremely busy with repair work, in addition to the new work on hand. Their great experience as repairers of breakdowns in rudder, quadrants, steering gear, &c., has enabled them to devise a speciality intended to prevent such mishaps, which seems now to be meeting with widespread adoption. This is the patent steering gear buffers designed to lessen the shocks of the sea on such parts as steering-gear chains, quadrants, rudders, stern-frames, &c. Between 60 and 70 vessels have already been fitted with the system of cushioning provided by these buffers, and numerous testimonials have been received from captains and owners testifying to their great utility and value. At the present time the firm have on hand amongst other orders one for a complete system of buffers, including rudder-head quadrants for a vessel of some 6,000 tons being constructed in England.

Numerous changes have recently been taking place in the proprietary and management of Clyde shipyards and engine shops. The oldest shipbuilding firm on the Clyde, that of Messrs. A. McMillan & Son, Dumbarton, has been converted into a limited liability company under the old title. The directors of the new concern belong almost exclusively to Dumbarton, and are for the most part gentlemen already interested in shipbuilding and engineering enterprise. Mr. R. McMillan, at one time a partner in the firm of A. McMillan & Son, will act as managing director; Mr. Hutcheson, hitherto manager of one of Messrs. Russell & Co.'s shipyards, Port-Glasgow, is to be the manager, assisted by Mr. A. Kennedy, formerly the head draughtsman. All the officials and workmen in the employ of the old firm have been discharged, and re-engaged as the servants of the new company. Mr. Peter Taylor, manager to Messrs. Lewis & McIlwane, Belfast, has been appointed manager of Messrs. Russell & Co.'s Port-Glasgow yard and graving dock, as successor to Mr. James Hutcheson. In room of Mr. J. H. Biles (who, as noticed in our last issue, has left the employ of Messrs. J. & G. Thomson, Clydebank, and become associated with the new Naval Works Co., Southampton) Mr. Samuel Crawford, hitherto assistant manager, has been appointed principal manager. Mr. Crawford has been assistant manager with Messrs. Thomson for fourteen years, and is well-known in the shipbuilding world, having occupied a leading position in the yards of Messrs. R. Napier & Sons and Messrs. John Elder & Co., where he gained great experience in the construction of the largest class of mail steamers as well as men-of-war for both our own and foreign Governments.

Mr. Geo. Herriot, senior engineer surveyor for the Board of Trade at Glasgow, has been appointed principal district officer for the West of Scotland, in room of Capt. W. B. Price, resigned.

The relationship existing between employers and employed in the shipyard of Messrs. Denny Bros, Dumbarton, has for long been one of the most cordial description. The employers encourage their workmen to improve the appliances and modes of work in vogue in theirown establishment by means of money awards, and in times of briskness there is far less unreasonableness on the part of their workmen in insisting on wage advances than of those elsewhere. In matters affecting the unfortunate, employés and employers alike are found willing to contribute help, and proof of this is found in the annual report just issued of the Leven Shipyard Accident Fund Society, which shows that the amount collected during the past twelve months from the workmen was £200 15s. 6d.; and fines £3 0s. 3d.; to which sum the Messrs. Denny add a like amount, viz., £203 15s. 9d.; bank interest £10 0s. 4d.; balance from last year, £226 4s. 10d.—making a total of £643 16s. 8d. The expenditure including £207 3s. 4d., paid in aliment, and £90 paid in three votes. There is a balance of £325 to the good on the year's expenditure.

At the third annual festival of the employees of the Grangemouth Dockyard Co., held in the Grangemouth Town Hall, on the evening of 7th March, Mr. Alexander Spence, one of the partners, speaking as chairman, gave some statistics which show how prosperous this company has been during the five years they have been in business. They have launched during that comparatively short period, 40 vessels, with a total tonnage of 30,000, and a deadweight carrying capacity of about 50,000 tons. Last year alone they launched from their two yards (including the one at Alloa, at which port they had been compelled to supplement their Grangemouth works) 14 vessels of 14,047 tons. Their weekly wages bill had increased during the five years from £600 to £3,500. The firm, however, have experienced inconvenience in the conduct of their business through the scarcity of workmen's dwellings at Alloa, and they have it under contemplation to build houses on their own account if provision should not be made in the ordinary way.

Symptoms of increased activity characterise present doings in connection with the new harbour works at Ardrossan. The work of dock-making proper has now been all but completed, the only remaining portion being the incline at the north-east corner of the inner dock, up and down which the wire rope way worked to remove the excavated material. Nearly the whole area of this inner basin, about ten acres in extent, has had to be cleaned out by means of boring and blasting, always a tedious undertaking. The depth of the dock is 35 ft. 9 in. below the level of the quays, and at present the granite coping is being placed round the dock walls, roadways are being formed, and a general surface finish being given to the quayage. Foundations, sites, &c., are being laid down for conveniences, and appliances designed to carry on efficiently and expeditiously a large traffic. The firm entrusted with the contract for the large installation of hydraulic machinery for the dock, the Hydraulic Engineering Co., of Chester, have their work well advanced. Their contract comprises two pairs of compound pumping engines, three boilers, accumulator, two hoists, three discharging cranes, and all the machinery for working the dock gates. The new outer basin is about seven acres in extent, and a channel about 400 ft. in width will be formed from the Dock to Crinan Rock and Lighthouse. The depth in channel and dock will be 18 ft. at low water and 27 ft. at high water. The substantial breakwater which is being erected to shelter the harbour from the north-west is now partially built for a length of 1,400 ft., 600 ft. of which has already almost reached the finished height of 6 ft. above high-water mark. For the accommodation of steamers to be engaged during the forthcoming summer season in the daylight service between Ardrossan and Belfast, special efforts are being directed to the deepening of the new steamboat pier, which also forms the terminus of the recently opened Ayrshire and Lanarkshire Railway. Two powerful dredgers are presently engaged alongside this pier following on the efforts of a large staff of workmen engaged on barges boring and blasting the rocky bottom, and it is expected ample depth will soon have been secured for berthing steamers of large tonnage. The firm of contractors presently carrying on the principal portions of the undertaking is that of Messrs. Lucas & Aird, London, and the engineers are Messrs. Strain & Robertson, Glasgow. The cost of the whole works, when completed, is expected to be close on £200,000.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOLS, TEES, &c.

THE TYNE.

Shipbuilding.—There is now no doubt that the top height of the briskness in shipbuilding was reached some time ago, and that the trade is at present and has been since the commencement of the year gradually but steadily declining. In the minds of some persons the expectation appears to exist that the increased employment for shipping which will be brought about by the early recommencement of North Sea navigation will have a stimulating effect upon the industry, but such a result is, to say the least, problematical, and they must be sanguine indeed who place much confidence in the fulfilment of the hope. At the Elswick Yard of Sir W. G. Armstrong, Mitchell & Co. the last orders are now in course of execution, and vessels recently launched have not been replaced on the stocks by keels for others. In a very short time indeed slackness will be felt at this establishment, unless some new orders are secured. At the Low Walker Yard of the same firm there is still a good deal of work in progress, besides several contracts not yet entered upon. A large vessel, which was built to the order of a Liverpool firm, was recently put off the stocks, and a sister ship is now being prepared for launching. The war sloop, which Messrs. Hawthorn, Leslie & Co. are building to the order of the Admiralty, is to be named the *Bellona*, and will very shortly be put off the stocks. The Palmer's Shipbuilding and Iron Co., who have five Government vessels to build, besides a considerable number of steamers for the Mercantile Marine, continue to have every berth in their two large yards occupied, and are employing more hands than perhaps at any former period. They are now making arrangements to add the manufacture of heavy guns and gun-carriages to their other large undertakings, and it is understood that the new department will be in operation before another year is past. Messrs. W. Richardson & Co. have still several vessels of a high class for foreign owners in course of building. Among these may be mentioned the s.s. *Chios*, built to the order of a Hamburg firm, and now being fitted out in the river; and the s.s. *Ragnvald Jarl*, ordered by Danish owners, and now nearly ready for launching. The shipbuilding yard at Scotswood, which was originally opened out in 1880, but which has been inoperative for several years, is about to be restarted by a South American company, who contemplate entering upon the somewhat novel enterprise of building for themselves exclusively. They intend, as soon as their arrangements for commencing work are completed, to lay down several steamers of a special type, to be employed in navigating the South American rivers. These vessels will be elaborately fitted up for passenger service, and will be supplied with machinery of great power to secure a high rate of speed. A gentleman of much experience from one of the leading yards on the Clyde has been entrusted with the management of the concern, and there is every reason to expect that, under his guidance, satisfactory results will be attained. The plant which was laid down by the last occupiers of the yard has never been removed, and as it is modern and in good condition, it will be available for use by the new proprietors. Some new plant, adapted to the working of steel as a material, will, however, be added, and it may be taken for granted that in the general equipment of the establishment, nothing will be lost sight of that can contribute to convenience and effectiveness of working. As already indicated, the company do not propose to go into the market in competition, for orders; but it is not improbable that in course of time they may, in addition to building river steamers, engage in the construction of iron or steel bridges for South America. At the annual meeting of the Mercantile Dry Dock Co., Limited which was held at Jarrow recently, it was announced that the construction of a second dry dock had been decided upon, the company's existing dock, which was only opened for use six months ago, having proved a success. The graving docks at Shields continue to be pretty generally occupied, and the accommodation of Messrs. Hawthorn, Leslie & Co's dock at Hebburn, which is one of the largest and most conveniently situated on the river, is in constant request.

Engineering.—The dispute of the engineering operatives with reference to the cessation of work at noon on Saturdays, which was referred to incidentally in last month's report, has now developed to the dangerous and unpleasant phase of a general strike, and is for the moment the one absorbing topic of conversation in the district. The whole of the men at the great Elswick Works (Sir W. G. Armstrong, Mitchell & Co.'s), as also those at Palmer's, Hawthorn & Leslie's, R. Stephenson & Co.'s, Wigham, Richardson & Co.'s, are "out," and there are several other large works affected by the strike, which it is unnecessary to enumerate here. Without entering into very minute details, it may be desirable to briefly indicate how this unfortunate state of things has arisen. Early in the year the workmen asked for a wages advance of 2s. per week, coupled with the reduction of the working hours from 54 to 53, thus changing the stopping time on Saturdays from one o'clock to twelve. In response to this demand the employers gave a shilling advance at the beginning of February. From the first, however, they made it clear that they were decidedly averse to any change in the working hours. At the end of February a conference took place between the employers and the representatives of the workmen, and the employers then offered to concede another sixpence per week, provided the claim respecting the working hours was given up. This the workmen refused to do, and at a second conference held early in March the employers increased the offer of a wages advance to a shilling weekly, but reiterated their determination to resist any reduction of the working hours. They intimated, however, that the men could cease work at noon on Saturdays instead of at one o'clock, in any shops where they were willing to work up the hour during the week. This offer was voted upon by ballot, and though the men in the Newcastle shops went largely for the acceptance of the employers' offer, they were outvoted by the other districts, and the strike accordingly commenced on the 17th inst. Nothing has since been done to bring about a settlement beyond offers of mediation by the Mayor of Newcastle and another gentleman holding a high judicial position in the district. So far, nothing has come of the attempts to mediate, and it remains to be seen whether these well-meant efforts will result in anything practical being done towards effecting a settlement. Under the circumstances there remains little to be said respecting the engineering trade of the locality, business being practically at a standstill, and though there is a good supply of work in the different shops, no progress to speak of can be made with it until the strike is ended.

Electric Lighting.—Messrs. Ernest Scott & Co., of the Close Works, have completed an electric lighting installation in the s.s. *Amur*, built by the Strand Shipbuilding Co., for the London and Libau Steam Shipping and Meat Co., and the working of the same has given complete satisfaction. The plant consists of the firm's "Tyne" Improved vertical engine and dynamo combined, driving 60 sixteen candle-power incandescent lamps, besides two cargo lamps of 500 candle-power each. The firm are now supplying a similar installation to a sister ship named the *Oxus*. A contract has also been secured for the lighting, with 45 incandescent lamps and 3 cargo lamps, of the *Pallas*. The generating power in this case will be derived from a "Tyne" combined plant. Messrs. E. Scott & Co. have also received additional orders for Admiralty pumps, the total number now on order being over fifty.

THE WEAR.

Shipbuilding.—A lessened pressure of work is now being felt in some of the yards on the Wear, and already a few empty berths are to be noted. Unless a renewed demand for tonnage should arise, the close of the present year will assuredly find shipbuilding at this centre in a state of exceptional dulness, and it is much to be feared that the other great centres of the industry will be in no better position. It is understood that one of the leading firms on the Wear have booked an order for a couple of large vessels within the past few days, but these are the only ones that have been contracted for in the district within a period of four months. At the North Sands yard the whole of the berths are occupied, the aggregate tonnage on the stocks being not less than 20,000 tons. In addition to this the firm have a couple of vessels receiving the finishing touches in the river, and they have also some repair contracts in hand. Messrs. R. Thompson & Sons have three vessels in progress at their Southwick Yard, and have just laid down one on the ground connected with the Bridge Dock. It is several years since the ground was utilised for a similar purpose. The handsomely finished cable ship *Relay*, which was lately launched by the firm, has had a successful trial trip, and has been found to be in every way admirably adapted for the special work in which she is to be engaged. The Sunderland Shipbuilding Co.

have four vessels on the stocks, and they have others to build, one of which will be laid down immediately. Messrs. John Blumer & Co. launched on the 21st inst. a steamer, ordered by the Trindad Steamship Company, London, for employment in the iron ore trade. The firm have still three vessels on the stocks, in different degrees of progress. Messrs. Priestman & Co. have four vessels on the stocks, and a large amount of other work to proceed with. It is understood that in the frame bending department night work is about to be resorted to. At the establishments of Messrs. Short Brothers, Messrs. Doxford, Mr. James Laing, and Messrs. Osborne & Graham, business is still brisk. Messrs. S. P. Austin & Son have sold to a Hull firm the s.s. *Barola*, launched in December last, and the vessel is now being got ready for handing over to her owners. The firm have two other vessels on the stocks, one of which will be launched in the course of a few days.

Engineering.—The strike of operative engineers for a reduction of the working hours to 53 per week has, as a matter of course, included Sunderland within its scope, and the whole of the larger works are consequently reduced to a state of almost complete inactivity. The apprentices continue at work, but as only a limited number of them have acquired any considerable degree of skill, their presence in the shops does not enable the employers to cope effectually with the needs of the situation. If the strike continues, the engining of vessels will, doubtless, be delayed, but this is not so great an evil as a similar stoppage of business would have been six months ago, shipowners not being so persistent in their demands for prompt delivery as they were at that period. The Scotia Engine Works is the only marine engineering establishment that continues in full work, and in this case the reduction of hours asked for has been conceded. Mr. William Laing, the inventor and manufacturer of Laing's patent ring and spring, is negotiating for conveniently situated premises at Monkwearmouth, in which to carry on the manufacture of his speciality on a more extended scale than hitherto. Through his agents, Messrs. Harrison & Co., of Bridge Street, Sunderland, he has already acquired a large part of the necessary plant, and there is now no doubt that in the course of a few weeks this new venture will be under way. Orders for the speciality are being received daily, and the course now being entered upon has been made necessary by their steadily increasing number. The Castletown Steel Works are kept very busy, and at the Monkwearmouth Iron Works there is still an abundance of work. Bell & Rockcliff's patent sections (manufactured at these works) are being supplied in considerable quantities to leading firms at the different shipbuilding centres, including the Clyde, the Thames, and the Mersey. The chain and anchor works of Messrs. Lumsden & Co. keep very busy, and there is still a good supply of work in hand.

The Hartlepools.—At this centre shipbuilding keeps very brisk in spite of the circumstances that new orders are less numerous, and that supplies of steel are difficult to get. The operative engineers have not as yet joined in the strike for shorter hours, and the engineering works consequently continue in full swing. Since the latter part of January Messrs. Thos. Richardson & Sons have engined at the shearlegs the following vessels:—The s.s. *Norse King*, with cylinders 28 in., 44 in., 72 in. by 48 in. stroke, and two large double-ended boilers, for Messrs. W. Ross & Co., London. The s.s. *Bona*, with cylinders 22 in., 35 in., 59 in. by 39 in. stroke, and two large boilers, for Messrs. W. Browning & Co., London. The s.s. *Ovingdean Grange*, with cylinders 23 in., 37 in., 61 in. by 42 in. stroke, and three large single-ended boilers, for Messrs. Houlder Bros., London. The s.s *Blenheim*, with cylinders 22 in., 35 in., 59 in. by 39 in. stroke, and two large boilers, for Messrs. Steel, Young & Co., London. The s.s. *Robert Eggleton*, with cylinders 21 in., 35 in., 58 in. by 36 in. stroke, and one large double-ended boiler, for James Westoll, Esq., Sunderland. The s.s. *Paranague*, with cylinders 23 in., 37 in., 61 in., by 42 in. stroke, and two large boilers for Messrs. the Chargens Reunis, Havre. During the same period four of the vessels mentioned above, namely, the *Blenheim*, the *Bona*, the *Ovingdean Grange*, and the *Robert Eggleton*, have had successful trial trips. Work at the Central Marine Engine Works is still plentiful, and during the past month a considerable number of vessels have been successfully completed. Amongst these may be specially mentioned a steamer for the Natal line of Messrs. Bullard, King & Co, viz., the *Umbilo*. This vessel in many ways marks a new departure, for this firm particularly, inasmuch as she is fitted with a manganese bronze propeller, cast at the Central Works. The vessel attained a speed of 12½ knots on her trial trip, the last knot of which was doubtless due to the propeller being of the metal named. A special furnace has been erected at the Central Works for dealing with manganese bronze propellers, and the firm are confident that at no distant date they will be doing a large business in this speciality, the advantage to vessels so fitted being such as to greatly overweigh the extra cost. The engines for the first of two large cargo steamers to carry 6,300 tons each, now building by Messrs. William Gray & Co., Limited, are progressing well towards completion. No less than 23 tons of metal was poured into the bed plate mould, and the result is a most beautiful casting. The condenser and cylinders are all in the shop, and their erection will shortly be proceeded with. These will be the largest engines yet made at the Central Works. The works have only been in operation for something less than five years, yet have engined within that period no less than 70 steamers, many of which were of large size, and none less than 500 indicated horse-power. The new forge department at these works is now in full swing, and although night shift has as yet been only partially adopted, the output is over 100 tons of forgings per month.

Stockton.—No symptoms of coming slackness are as yet apparent in the Stockton shipbuilding yards, and for months to come there is reason to expect that the machinery will be kept briskly going. The fitters at Messrs. Blair & Co.'s works have come out on strike for the 53-hour week, and there is therefore little doing at this usually busy establishment. Since March 20th the following steamers engined by the firm have had their trial trips:—The s.s. *Moldara*, built by Messrs. C. S. Swan & Hunter, Wallsend, for the Mercantile Steamship Co., London, with engines of 175 H.P. nominal, having cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The s.s. *Castlefield*, built by Messrs. Richardson & Duck, of Stockton, for Messrs. Bennington & Co., having engines of 160 H.P. with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. The s.s. *Gladestry*, built by Messrs. R. Irwin & Co., West Hartlepool, for Messrs. Seiveright, Bacon & Co., having engines of 170 H.P. with cylinders 21½ in., 35½ in. and 58½ in. by 39 in. stroke. The engines for these vessels have been constructed to work up to 160 lbs. pressure of steam, and on their trials gave complete satisfaction.

Middlesborough.—At this centre shipbuilding continues active, and the engineering works and foundries are still well off for orders. In the steel works, pressure of business is still the rule, and iron works are generally well employed.

Darlington.—The Darlington Forge Co.'s works show sustained activity, the weekly output continuing to be very large. The North Road railway shops are very busy, and at the waggon works orders are plentiful. Other local industries, including steel works, are showing evidences of continued prosperity.

Consett.—Exceptional briskness still characterises the steel works at Consett, and an advance of wages has just been conceded to the operatives.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—There is very little variation to note in the shipbuilding and engineering trades of this district. No new orders have been booked during the month, and the enquiries which have been received have not represented a large tonnage of shipping. It is, indeed, a fact that when the demand was brisk, as was the case a few months ago, builders could not secure some of the orders they had offered to them because of the prohibitive cost of material. Some additional contracts for firms which had already entrusted work with local builders were withdrawn on these grounds, and while at the time it was decided to wait till the prices of material were easier, it is evident with present prospects owners are not so much disposed to build new ships as they were in the beginning of the year. There is, however, the fact to be looked at that several of the large steamship owners are likely to be in the market when prices get to a low point, and important work is expected from these sources. A disposition was distinctly shown on the part of owners of steamers, when prices of building were very high, to convert old engines into triple-expansion engines, and thus make their old steamers practically equal to new. It is argued that while vast strides have been made in marine engineering during recent years, there has been no material advance in the shipbuilding trade itself, and the vessels built on old-fashioned lines are not much worse than new ships when they are fitted with triple-expansion engines. Much work of this class has already been done at Barrow, and at present an order is in the hands of the Naval Construction and Armaments Co., Limited, for building three sets of triple-expansion engines and steel boilers for some of their steamers now employed in the Pacific service. Other orders are expected, not only by the Naval Co., but by Messrs. Westray & Copeland, Limited, who have already done good work of this class. The Naval Construction and Armaments Co. have made great progress with the second-class cruisers, which are being built for the Admiralty, and it is confidently expected one of these will be launched first of the series now building. The first of the three Canadian Pacific Co.'s steamers, building at Barrow, will not be launched till August, but the interregnum will be utilised on the engineering side of the yard by the large repair orders already in hand. The delays are not so frequent and so serious for the want of material as they were some time ago, but some inconvenience is being caused at the Barrow yard by a strike of joiners. Two hundred men are on strike on the question of an advance of from 34s. to 36s. per week in their wages, and on a question as to extra pay for overtime. Many of the men have left the town. The efforts which have been made for some time past to dispose of the Graving Dock Shipyard at Barrow have ended in failure just when they were on the point of realisation. Some difficulty arose as to the price in the final arrangements, and Mr. Johnson, the late manager of the Whitehaven Shipbuilding Co., who was negotiating to purchase the place, has thrown up the scheme and accepted a situation on the Tyne. The Furness Shipbuilding Co., Limited, are contemplating going into the trade of iron and steel shipbuilding. Up to now they have confined their attention to wood shipbuilding, repairing work, &c.

Whitehaven.—The shipbuilding yard at Whitehaven is still idle, and the work of realising the estate and winding up the affairs of the Whitehaven Shipbuilding Co. is proceeding.

Maryport.—Considerable activity is observable in the shipbuilding trade of Maryport, and it promises to become a much more important industry than at present.

THE MERSEY.

THE whole outlook of trade is disturbed and unsettled by labour disputes and constant agitations on the part of the workmen for higher wages, shorter hours, and various other demands in one shape or another, all tending to render the conduct of industrial operations more and more difficult. The end is not difficult to foresee, and already some of the results are making themselves unmistakably evident. For the time being most of the shipbuilding yards and marine engineering shops on the Mersey are being kept fairly busy, but they are securing little or no new work, and as present contracts run out the prospect in the immediate future is anything but hopeful. The general strike of dock labourers, carters, and other workmen connected with the handling of goods for export and import at the docks on both sides of the Mersey, although very serious in its results upon the shipping trade at both Liverpool and Birkenhead, does not directly affect the shipbuilding and marine engineering industries, but it adds to the widespread feeling of unsettlement, and in conjunction with the coal miners' strike, so disturbs and disarranges all other branches of industry upon the prosperity of which the maintenance of activity in shipbuilding must necessarily depend, that indirectly shipbuilders and marine engineers cannot fail to be sufferers from the resulting general turmoil and disruption of trade; but, in addition, engineering firms throughout the Liverpool district have now to meet further demands from their men for higher wages, notices having been sent in for another advance of 2s. per week, and this may lead to considerable trouble, as the prospects of trade are certainly not such as to justify the employers in granting further concessions in the above direction to their workmen. It is true that in most cases there are still orders in hand for the equipment of vessels which will keep engineering works well employed for some time, but as regards new orders there are extremely few now coming to hand. With regard to shipbuilders very much the same may be said; with the exception of Government work there has been comparatively little or nothing given out on the Mersey since the commencement of the year, and in some instances where vessels have recently been launched the berths are now empty, with no prospect of orders being secured on which they can again be filled up with the erection of new vessels. Shipowners, on the one hand, decline to follow the constantly advancing prices which shipbuilders have had to quote for new work, and they hesitate to give out orders for new vessels; whilst, on the other hand, shipbuilders are placed in the position of such constant anxiety and uncertainty as to the action their workmen may take that they scarcely dare commit themselves to any really definite periods for the completion of new work that may be offered to them. A considerable fall in freights is also another element which is now coming into operation in checking the further building of new vessels, and altogether the prospect is decidedly most unsatisfactory. Other branches of industry which supply raw material for the shipbuilding and marine engineering works are also following in the same direction, and both iron and steel are not only giving way in value, but there is an absence of any buying going on to really test the prices which makers and manufacturers would now be willing to accept to secure orders. Messrs. H. E. Moss & Co., of Liverpool, in their quarterly circular issued during the past month, state that notwithstanding the enormous amount of shipbuilding during the previous year, the results to the shipbuilder and engineer cannot be said to be satisfactory, the statements published by the various public companies and some recent failures showing that they have not equally profited by a very busy year. The tonnage building in hand on January 1st, 1890, was 828,000 tons, of which they are pleased to note that nearly five-eighths was for regular lines, and considerably less than half were ordinary cargo steamers. The prices of steamers and sailers were fully 25 per cent. higher than in January 1889, but several builders now began to see daylight and were eager for orders. So far, however, as prices were concerned, they did not expect any serious reduction in 1890, the large tonnage on Government account helping materially to stiffen prices. The increase of British tonnage in the year 1889 was of steamers 650,000 tons less decrease in sailers 110,000 tons, is a net increase of 54,000 tons, but notwithstanding the considerable increase, they did not hear of any steamers being laid up or of the general depression which prevailed in 1884-5. One effect, however, of the facts named above was apparent from the greater readiness shown by holders of secondhand vessels to realise, and buyers of this description of property could certainly get better value for their money than they could a few months since. Tonnage was, however, strongly held, and Messrs. Moss & Co. see no reason to fear serious consequences, even if in a few isolated cases values were forced, very few contracts had been broken through impecuniosity; and though smaller dividends were a certainty, investors might still rely on receiving a fair interest on their investments. Steel was more than ever the favourite material for hulls, but it required great care and more frequent painting than iron; the advantages, however, gained by using it more than counterbalanced its disadvantages. Foreigners were still buying largely, and the requirements of our own colonies were an important factor in all calculations. In steam tonnage they were equal to all the rest of the world, and they were by far the largest carriers for other nationalities. Prices for steel sailing ships were from £11 per register ton for ordinary vessels to £14 for smaller; and steamers of average power could be built 4,000 to 6,000 tons at £9 10s. on deadweight capacity; and proportionately higher rates for smaller sizes. The average size of both sailers and steamers was increasing every year, and a very large proportion of tonnage in construction exceeded 4,000 tons.

Messrs. Laird & Co., who are very busy throughout their yard, largely upon work both for English and Foreign Governments, have launched the second of the torpedo gunboats which they are building for the Chilian Government. This boat has been named the *Almiranti Condel*, and is a sister vessel in every respect to the *Almiranti Lynch*, which was launched from the same yard on the 10th ultimo., and of which we gave full particulars at the time. The vessels are an enlarged edition of the well-known *Rattlesnake* of our own navy, and it is expected by their designers and builders that they will prove themselves as great a success as that vessel has done. They have a length over all of 240 ft., with 27 ft. 6 in. beam, and a maximum draft of 9 to 10 ft. They will be fitted with two pairs of triple-expansion surface-condensing engines with four boilers of the locomotive type, and when working under forced draught will be capable of exerting 4,500 H.P., with which a speed of 21 knots is expected. The armament will consist of Hotchkiss' three 14-pounder and four 3-pounder quick firing guns, two of the former being arranged on the forecastle so that they both fire right ahead, the third on the poop at the after end, commanding a range right round the stern, as well as two five-barrelled Gatling guns placed in a commanding position on the top of the pilot tower. The torpedo armament consists of five torpedo guns, one fixed in the bow and the other four in the broadside arranged to give a considerable angle of training. Good freeboard at the ends, very essential in this class of vessel when being driven fast into a seaway, is secured by topgallant forecastle and half-poop which also increases the space available for accommodation; this, both for officers and men, will be ample. The vessel is fitted throughout with electric light, and will also have a powerful 25,000 C.P. search light. The *Almiranti Condel* was christened by Miss Brounell, the ceremony taking place in the presence of Admiral Latore, of the Chilian Navy and other officers. Messrs. Laird Bros. have also during the month launched from their works at Birkenhead a very fine and strikingly handsome steam yacht, built to the order of Mr. S. R. Platt, of Oldham, from designs by Mr. St. Clare Byrne, of Liverpool, the well-known yacht designer. This is the second yacht built by the firm for Mr. Platt, and she has been named the *Norseman*. The *Norseman* has been designed to combine good speed under steam with first-rate sailing power when cruising under sail alone, and with that object has been fully rigged as a square-rigged schooner, spreading a large area of canvas and fitted with a Bevis patent feathering propeller. She is built entirely of Siemens-Martin steel up to the gunwale, with bulwarks, deck-house, companions, and indeed all deck fittings of teak; and is supplied with steam windlass, fire-engine pump, screw swinging gear, &c., of the most modern and improved kind. The masts are by Mr. J. S. White, of Cowes, and the sails by Messrs. Lapthorn and Ratsey. Her dimensions are—length, over all, 152 ft. 6 in.; beam, 23 ft.; depth, amidships, 13 ft. 6 in., with a tonnage of 327 O.M. She is fitted with bilge keels, which will very sensibly reduce her rolling when under steam. Her machinery, which has been put on board in the docks and has been tested under steam, consists of a set of vertical triple-expansion engines having cylinders 13 in., 19½ in., and 33 in. in diameter with 2 ft. stroke, working at 150 lbs. pressure and capable of developing 350 I.H.P. The boiler is cylindrical, of steel with two corrugated furnaces and the crank-shafts, pistons, and other parts of the machinery are of steel. The arrangement of the cabins is somewhat similar to that in the old *Norseman* (Mr. Platt's previous yacht), the main saloon fitted in framed mahogany and the walls covered with rich and artistic material being forward of the engine space, and forward of this are the main entrance from the upper deck, and the pantries, lavatories, captain's, officers', and crew's quarters. The after end of the vessel, which is reached by a corridor through one side of the engine-room and shut off by a watertight bulkhead furnished with water-tight doors, contains seven state-rooms (three or four of large size), beautifully fitted in various hard woods and the walls richly draped. On the upper deck amidships there is a large deck-house built of finely-mottled teak, which is quite a feature in the vessel, the fore part forming the companion-way and smoking-room fitted in rosewood, and the after part the galley, from which a lift communicates with the saloon. Immediately on leaving the stocks the *Norseman* made a short trip on the river under steam, when the engines worked excellently and the vessel appeared to go at a high speed. Messrs. Thomas Royden & Sons have during the month launched the s.s. *Indrapura*, of which some particulars have already been given. This vessel is 369 ft. long, 44 ft. beam, and 27 ft. 7 in. deep, with a registered tonnage of 2,510, and a gross tonnage of 3,859. It has been built for the carrying trade and will go out to Bombay on her first voyage with a cargo of coals. The engines for this vessel, which have been supplied by Messrs. Fawcett, Preston & Co., Limited, of Liverpool, are of 2,200 H.P. and triple-expansion with three cylinders and three cranks, inverted direct-acting and surface condensing. Weir's feeding engine is supplied along with heaters and evaporators. The cylinders are respectively 27 in., 44 in., and 71 in. diameter with 48 in. stroke, and working at 150 lbs. pressure. The boilers are all steel of the ordinary marine multitubular type. The first trial trip of the vessel was made from the Mersey to the Irish Sea, the engines working most satisfactorily in every respect, and there was not the slightest hitch of any kind during the whole of the trip. The firm have not received any new work beyond the orders in hand, which have been previously referred to, and are preparing to launch this month another of the vessels they have on the stocks, the *Saladin*, which is being built for Mr. Alfred Holt for the Eastern trade. Messrs. Potter & Sons have nearly ready for launching a steamer which they are building for Mr. Alfred Holt. This vessel is 220 ft. long by 34 ft. beam, and 15 ft. deep, with engines of about 85 H.P., supplied by Messrs. Fawcett, Preston & Co. This vessel, which is intended for trade in the East, is the fourth steamer which the firm have built from precisely the same model for Mr. Holt. They have also in hand a steel sailing ship of 2,800 tons register for Liverpool owners, and an iron sailing ship of 2,300 tons for German owners.

It will be interesting to mention that Sir Joseph Whitworth & Co., of Openshaw, near Manchester, have in contemplation the erection of additional works in the immediate neighbourhood of the Manchester Ship Canal, which are specially intended for the erection of marine boilers, and other marine engineering work. At the recent Manchester Exhibition Sir Joseph Whitworth & Co. exhibited a weldless boiler ring 12 ft. diameter and 6 ft. long, which at the time attracted very considerable attention; and at their new works it is their intention to lay down plant for the construction of boilers built up of weldless rings, for which it is claimed that, whilst they reduce the weight of the boiler by 30 per cent., it is, at the same time, kept up to its full strength. This it is obvious is a very important feature in the construction of marine boilers, as contributing largely to the increased buoyancy of the vessels in which they are placed. So far no marine boilers have been constructed on this principle; but that there is no difficulty in manufacturing these weldless boiler shells for the purpose has been fully evidenced by what Sir Joseph Whitworth & Co. have already accomplished. In some instances these shells would go up to 14 ft. diameter; and as it is obvious that the difficulty of carriage with such large pieces of work, either by rail or road, is practically insurmountable, it is absolutely necessary that any works for their manufacture should be placed on the water side. This has induced Sir Joseph Whitworth & Co. to take in hand the erection of special works on the banks of the ship canal, although at their existing works at Openshaw they have all the plant requisite for the production of these large weldless boiler shells.

In the iron and steel trades, in fact in the market for all descriptions of material required for shipbuilding and marine engineering work, there has been an extremely slow business doing during the past month, with a gradual easing down in prices. In pig iron local and district brands delivered equal to Manchester or Liverpool could now be bought without difficulty at about 60s. to 61s. per ton less 2½ per cent., whilst in outside brands cheap secondhand parcels both of Scotch and Middlesboro' have been offering freely at far below makers' quotations, and the latter have been altogether out of the market, good foundry brands of Middlesboro' being obtainable at about 60s. net cash delivered in this district, whilst Eglinton has been offering freely at about 57s. delivered at the Lancashire ports. Hematites have also eased down very considerably, and where business has been done, 80s. less 2½ has been about the top figure obtainable for good foundry brands delivered here. In finished iron, makers have been quoting about £8 5s. to £8 10s. for local, and about £8 15s. for North Staffordshire bars delivered here, but merchants and dealers have been offering at considerably below these figures. Steel plates, both for boiler-making and shipbuilding purposes, have been only in most limited request, buyers evidently all holding back in the expectation that by waiting they will be able to place out orders at much lower prices than the present. Boiler-makers are mostly well covered for present requirements, while in the shipbuilding industry the falling off in new orders coming forward has necessarily tended to check buying of any weight in ship plates. Quotations for delivery ex steamer Liverpool are about £10 10s. for boiler plates, £9 10s. for ship plates, £9 5s. for flat and square bars, and £8 15s. for angles, but these are little more than nominal prices, as there is really no business doing on the basis of these figures, and in most cases makers are open to entertain offers when buyers have orders of any weight to place.

The metal market remains without change; there has been very little new business given out during the month, but as manufacturers are mostly well covered with orders on their books, they have not given way on their list rates, which remain practically the same as those last quoted. Here and there, however, sellers have been easing down a little to secure orders, but this has not affected the general market quotations.

The timber trade, as is usual at this season of the year, has been quiet. The deliveries have been fair, but prices generally are lower, and the stocks of most articles are still too heavy.

The coal trade has necessarily, for a week or so, been very much unsettled by the miners' strike for a further advance in wages, and during the stoppage of the pits all kinds of fancy prices have in many cases been paid to secure supplies. Now that the wages question has been settled by practically conceding the demands of the Miners' Federation, prices are gradually getting back to something like their normal condition, but some advance has been made upon previous current rates to cover the advance in wages, and this will leave pit prices at something like 12s. 6d. to 13s. for best coals, 11s. 6d. to 12s. for seconds, 9s. 6d. to 10s. 6d. for common coals, 8s. 6d. to 9s. for burgy, and 7s. 6d. to 8s. for slack, but it will remain to be seen how far the demand will enable colliery proprietors to maintain their present position. Shipping has been quite at a standstill, owing to the combined effects of the miners' strike and the dock labourers' strike, and it will take a week or so before this branch of the trade returns to its normal condition.

WELSH NOTES.

THIS is, perhaps, scarcely the place in which to refer to cruelty to animals, but we feel bound to place on record our detestation of the inhumanity at the Morfa Colliery after the recent explosion. As our readers know, it was considered necessary to flood the mine on account of fire breaking out in the workings some days after the explosion. During the intervening time no attempt was made to bring to bank a number of horses in the pit, and when flooding was finally decided upon no one was allowed to go down to rescue the poor animals, although there were volunteers enough. Of all the utter shams on the face of this earth, verily we Englishmen occupy the foremost place. And now let us proceed to business.

The Liverpool dock strike has done some good to Newport. Messrs. Lamport & Holt and other firms having sent their steamers to the port to load outward cargoes. Amongst the cargoes is one of galvanised iron for the River Plate, which but for the strike would have been shipped in the Mersey as usual. Commenting upon this, the *South Wales Daily News* draws attention to the fact that it costs more to send the iron from the Bristol works to Newport than it does to send the stuff to Liverpool. Hopes have been expressed that now Messrs. Lamport & Holt have commenced sending steamers to Newport they will continue doing so; but it will be necessary, in the first place, to get reasonable railway rates; and in the next, that the Alexandra Dock Co. treat the owners of the line in a different manner to that in which they are said to have treated the pioneers of the trade at Newport, Messrs. Houlder Brothers, for whom they declined to erect the necessary cold air sheds for the foreign meat.

Newport has recently been christened the Niobe of the Welsh ports, for the reports of her trade show a gradual shrinking. For February all the Welsh ports showed an increase except Newport. What the end is to be nobody dares to say. The dock authorities may rouse themselves when it is too late, but there is no satisfaction in that.

Since our last issue the annual report of the Bristol Great Western Steamship Company has been issued, and it is satisfactory to learn from it that the year's work has been so profitable as to enable the directors to declare at the rate of 7½ per cent., which, with the interim dividend of 10 per cent. last July, makes 17½ per cent. for the twelvemonth's trading. By the way, we hear a rumour that this company may shortly recommence their American service.

Ship repairers in this part of the world seem fated to have a sorry time of it with their workmen. It is not very long since Messrs. Mordey, Carney & Co., of Newport finished a serious trouble with their workmen; some Cardiff people had a tussle with their men; Swansea had its share, and now has come the turn of Cardiff again. The unfortunate company this time is Mountstuart. The company employed a man as haulier at a certain weekly wage with an agreement for overtime. The manager offered to pay the haulier an increased weekly wage if he would forego this overtime. Acting under the advice of the National Labourers' Union, of which he was a member, the man paid no attention to the proposal with the result that he was dismissed. The haulier taken on in his place was a non-unionist, which fact becoming known to the Union led to a strike of all the men employed in the yard. At a conference between the masters and men, held later, the former stated they had decided to sell their horse and have the haulage done by contract. As a result, the men resumed work pending a further conference with the masters. This conference has not been held at the time of writing this, but the Union find the horse has not been sold, that the so-called "blackleg" has become a member of the Union, and suppose, in addition, that arrangements have been made by which the company can have their work done by other firms should a second strike ensue. This is too much for these so-called "sons of toil," and if their suppositions turn out to be correct they are preparing for a strike not only at the yards to which any of the Mountstuart work may be sent, but throughout the port. This is a very serious matter, for associated with the Union are riggers, coal trimmers, and labourers generally. In plain English, the Union are prepared to stop the trade of Cardiff for a reason nobody can understand. Is it not about time that the Government took up this sort of thing? The rights of property no longer exist now that a party of shouters have got the whip hand. By all means let us recognise the rights of labour, but let us have some common fairness as well.

At last the directors of the Barry Dock Co. have decided to proceed with the construction of a commercial dry dock, and the work is to be proceeded with at once. It would be interesting to learn how many shares in the existing Barry Dry Dock Co. have recently been transferred to the general public.

At the annual meeting of the South Wales Institute of Engineers, held on the 20th ult., Sir William Thomas Lewis was elected president for the ensuing two years. There is some talk of the Institute joining the Coal Owners' Association and the two bodies erecting a building in Cardiff for the purposes of the two societies.

It is stated that the output of minerals in Monmouthshire and South Wales last year exceeded 1888 by 2,250,000 tons.

BELFAST TRADE NOTES.

BELFAST has now apparently got over the strike epidemic, which bids fair to rival that late visitor, the influenza, in the rapidity with which the United Kingdom has been overrun with strikes lately.

Messrs. Harland & Wolff, Queen's Island, are still very busy and have three ships at the finishing berths, and in the course of a fortnight will have two launches. Sir E. J. Harland, M.P., has accepted the invitation of the Government to preside over a committee of the Board of Trade on the subdivision of merchant ships by means of watertight bulkheads.

Just after we went to press with our last report the s.s. *Nizam*, built by the above firm, sailed for Liverpool. The s.s. *Majestic* having been finished is now in Liverpool, and her maiden trip is being looked forward to with great interest, her propellers are different from the *Teutonic's*, having only three blades while the latter's have four, and better results are expected, and her ventilation will be much superior.

It is stated in the Dublin press that Messrs. Harland & Wolff are about to take over the shipbuilding yard of Messrs. Bewley, Webb & Co., at the North Wall, Dublin, and that an order has been given by a Dublin shipowner for a steamer to be built in it. It is to be hoped that such may be the case. This yard, which offers great facilities for extension, has (although some fine steamers were built in it some years ago) been in a very dormant state, and is the only place of the kind about Dublin, and is in a very good situation for the shipbuilding industry.

Messrs. Workman, Clark & Co. still continue as busy as they have been for the past twelve months. On the 22nd March the fine steamer *Chichester*, built to the order of Mr. Rea, Belfast, was towed to Glasgow to receive her machinery, while another large steamer is almost ready for the same. They will have some launches shortly.

Messrs. McIlwaine & Maccoll, Limited, are fairly busy, and, we understand, are about to take over and finish some of the jobs contracted for by the firm of Messrs. Forrester, of Liverpool.

The *Gibraltar*, one of England's old wooden walls and stationed at Belfast as an Industrial School, will no longer be known by the old name, the Admiralty having changed her name to the *Grampian*, as they want the name *Gibraltar* for another vessel.

FAST STEAMING FROM THE CAPE.—The Union Steamship Co.'s Royal Mail steamer *Tartar*, which left Cape Town on the 19th February, at 5.43 p.m., arrived at Southampton at 8.56 p.m. on Sunday, the 9th inst., her gross passage being 18 days 3 hours 13 minutes, and her net steaming time 17 days 20 hours 37 minutes. The distance run was 5,987 miles, giving an average speed of 14 knots per hour over the whole course.

LEITH NOTES.

THE engineering and shipbuilding trades are still busy, but a slacker time seems imminent, and though repair orders are numerous, new work is scarce everywhere, while amongst the workmen generally a settled feeling prevails, making the masters more confident in their estimates for new work. The Grangemouth Dockyard Co. are at present turning out a large quantity of work. On the 21st February they launched a steel barque, named the *Bankburn*, of 2,300 tons deadweight capacity; on the following day a small steel screw steamer, named the *Banes*, of the following dimensions—Length, 180 ft.; breadth, 28 ft.; depth of hold, 12 ft. 9 inches; and on the 11th March a handsomely modelled steel screw steamer, named the *Managua*, built to the order of Johann C. Giertsen, of Bergen, for the fruit trade between New York and the West Indies. On the 7th March Messrs. Hawthorn & Co., Leith, launched the last of an order of six barges for Her Majesty's Dockyard.

The event of the month was the opening of the Forth Bridge on the 4th March by H.R.H. the Prince of Wales, who drove home the last rivet in the bridge and declared it open. The line as yet is only open to passenger traffic as far as Dunfermline, though goods trains are being run to Dundee, Aberdeen, and the north, *via* the bridge. This withdraws the luggage traffic from Granton, thereby rendering the huge luggage boats which previously carried the trains from Granton to Burtisland, a feature of the past.

A new company, called the Lothian Coal Co., Limited, has been formed for the purpose of acquiring and further developing the collieries of Newbattle, carried on by the Marquis of Lothian, and Whitehill, carried on by Mr. Archibald Hood, together with leases of other mineral fields held by them jointly or by Mr. Hood. The Newbattle coal is of the first quality, and has long been known as such both at home and abroad. The situation of the collieries is very favourable, offering every facility for transport either by land or sea. The gales during the past month have been very detrimental to the progress of the International Exhibition, which has suffered on several occasions, though not very seriously.

MISCELLANEOUS.

North-East Coast Institution of Engineers and Shipbuilders.—On the afternoon of Wednesday, March 12th, the graduates of the above institution paid a visit to the locomotive works of the North-Eastern Railway Co., at Gateshead. In the evening a general meeting of this section was held in the Institution's reading-rooms, Newcastle-on-Tyne, when Mr. Balfour Bramwell read a most interesting and instructive paper on "Steam Engine Trials." He described very fully the method of carrying out a complete steam engine and boiler trial, and explained how a full engine and boiler heat account was made up. Then, by comparing a series of trials, in the carrying out of which he had assisted, on a small horizontal engine at University College, London, he deduced several results, amongst which was the great saving of 16 per cent. effected by jackets when properly applied and looked after. He referred particularly to the want of attention to jackets on marine engines, and strongly advocated the use of automatic drain arrangements from the jackets, such as steam traps. He then referred to the efficiency of the engine, and pointed out the absurdity of trying to arrive at the true efficiency of an engine from combined diagrams when the feed water had not been measured. The discussion which followed was adjourned till the next meeting.

The United Asbestos Co., Limited, late of 161, Queen Victoria Street, seems to be getting their share of increasing business, for they have lately removed to large and commodious premises recently occupied by the East and West India Dock Co. in Billiter Street, E.C. There is no doubt that the late introduction of high steam pressure into the Naval and Commercial Marine will afford a great stimulus to asbestos producing and working firms, and companies, as the higher temperature proves destructive to ordinary packing and non-conducting material. It is well known in the trade that there is a good deal of difference in the quality of asbestos obtained from different places, and when the short fibre is used its inferior quality shows itself in the quality and durability of the goods manufactured. It is therefore evident that the United Asbestos Co. have been careful to supply only the most satisfactory material, otherwise they would not have acquired the position they now hold, or have effected their late increase of business. They are owners of mines in Italy and Canada, and since they are also their own manufacturers, having extensive works at Harefield, they ought to be able to do a good trade at a moderate price. We see they have invented a new material called "Asbestolio," a cleansing and polishing soap, the effects of which are said to be very good upon the brass work so much used for decorative purposes on board ship, where no doubt the new polishing material will be found useful.

Quick Work.—The Bute Docks Co.'s tippers, in conjunction with Messrs. Worms, Josse & Co.'s trimmers, have, by means of the movable tips on the west side of the Roath basin, done some remarkable work in coal-shipping. The s.s. *Byron*, carrying 3,104 tons, commenced loading on Monday, 24th February, and finished Tuesday afternoon. The steamer *Syria* followed and took 3,002 tons, finishing on Wednesday afternoon. The s.s. *Arbib Brothers* then went into the berth to load 4,243 tons, and finished Thursday evening. The following details will be interesting: The s.s. *Byron*, under tips 22 hours, less stoppages 11½ hours, net loading time 10½ hours, average shipment per hour 295 tons. The s.s. *Syria*, under tips 22 hours, less stoppages 13½ hours, net loading time 8½ hours, average shipment per hour 353 tons. The s.s. *Arbib Brothers*, under tips 29 hours, less stoppages 19 hours, net loading time 10 hours, average shipment 424 tons per hour. Between 4 and 5 p.m. on Wednesday, 25th February, when the tips were working on the last named steamer the total quantity shipped was 596 tons in one hour.

Sale of a Tug.—On 5th March, Messrs. Tregerthen, Dunn & Co. sold by public auction the wooden steam-tug *Pioneer*, of Cardiff, as she lay in the West Bute Dock. The *Pioneer* was built by Messrs. Hepple & Son, Low Walker, in 1833, and is fitted with engines of 24 H.P., 28 in. cylinders, with a stroke of 3 ft. 9 in. There was a remarkably good attendance of steam tug proprietors from Liverpool, Cardiff, and other places. The first bid was £70, and this figure speedily ran up to £200, at which price it changed hands.

The Security of Ships in Case of Collision.—It is reported that the President of the Board of Trade has appointed a committee of experts in shipbuilding to consider how best to secure the safety of ships at sea in case of collision, and to report specially with reference to the extended use of bulkheads in the construction of ships. The committee consists of the following gentlemen:—Sir Edward Harland, M.P., Mr. Thomas B. Royden, M.P., Mr. Alexander C. Kirk, Professor Philip Jenkins (Glasgow University), Mr. James G. S. Anderson, and Mr. James Laing. The committee will meet at the Board of Trade offices for the first time on Thursday for the regulation of their future proceedings.

W. B. Thompson and Co. (Limited).—The annual meeting of the shareholders of W. B. Thompson & Co., Limited, engineers and shipbuilders, was held in Lamb's Hotel, Dundee, on February 28th. Mr. Wm. Moir, the chairman, presided. The Chairman moved the adoption of the report, which recommended the payment of a dividend at the rate of 3 per cent., and that the balance of £772 9s. 1d. be carried forward. He said the directors very much regretted that the result of the year's working had not been much more satisfactory than stated in the report. They certainly did not anticipate any brilliant results, although it was expected that the year's working would have been as satisfactory as during the former two years. The company had a fair share of the business which was doing, but unfortunately the increase which had taken place in the wages had been the means of very much reducing the profit on several vessels which had been launched. In this way from 20 to 25 per cent. had been taken away from their expected profits. They had also to contend against non-delivery or late delivery of material. This had also enhanced the cost of production, as well as resulted in inconvenience to friends and non-delivery of vessels. This was a thing entirely beyond their control. Had the wages continued on a moderate scale, a very handsome and satisfactory dividend would have been yielded. They could only hope, as they were getting on to more favourable contracts, and with the prospect of more ease in the material as well as the labour market, that they would be able to report more favourably at next annual meeting. Including the 3 per cent. to be declared that day, the average percentage for the three years the company was in existence had been 6 per cent. Ex-Provost Ballingall seconded the motion, which was adopted.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Richard Simpson.—On February 22nd Messrs. Cook, Welton, & Gemmell launched from their yard, at Hull, a steam trawler named *Richard Simpson*, built for the Humber Steam Trawling Co. The *Richard Simpson* is a new departure in the fishing industry of the port, for she has a well, and will be able to introduce the live fish industry into Hull. The steamer is 110 ft. long, 20·9 ft. broad, and 11 ft. deep. She will have engines of about 50 N.H.P., which have been designed and built by Messrs. C. D. Holmes & Co.

Yumuri.—On February 25th Messrs. Raylton, Dixon & Co. launched from their Cleveland Dockyard a steel screw steamer named *Yumuri*, which has been built to the order of Mr. P. G. Pettersen, Bergen, Norway, and is of the following dimensions:—Length, over all, 204 ft.; breadth, 28 ft.; depth, moulded, 21 ft. 10 in., with a carrying capacity of 1,070 tons. This vessel is built to Lloyd's spar-deck rule, to class 100 A1, and is intended for the fruit trade from the West Indies to New York. Her engines are being built by Messrs. Westgarth, English & Co., Middlesborough, on the triple-expansion system, with cylinders, 17½ in., 29 in., and 47 in. by 33 in. stroke, which will develop a speed of 11½ knots. She is fitted with patent direct steam windlass by Emerson, Walker & Thompson Bros., Limited.

Penrhyn Castle.—On February 26th Messrs. Charles Hill & Sons, Bristol, launched the *Penrhyn Castle*, which has been built entirely of steel to the order of Messrs. R. Thomas, of Criccieth, North Wales. Her dimensions are:—Length, 237 ft.; breadth, 36 ft. 6 in.; depth, 21 ft. 6 in. Her registered tonnage is 1,349, and she will carry 2,250 tons deadweight.

Perou.—At the yard of Mr. James Laing, Sunderland, a steel steamer, built to the order of the Compagnie Maritime du Pacifique, of Havre, has been launched. She is of the following dimensions:—Length 340 ft.; breadth, extreme, 41 ft.; depth, moulded, 29 ft. The vessel is rigged as a three-masted schooner. She has been classed 100 A1 at Lloyd's, as a spar-decked steamer, and to the highest grade in French Veritas (1) L. 3.3.1.1. +. The vessel was named *Perou*.

Cossack.—On March 5th there was launched from the yard of Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, a steel screw steamer, built to the order of Prince Troubetskoy, of Moscow, Russia. The principal dimensions are:—Length, over all, 208 ft.; beam, 30 ft.; depth, moulded, 13 ft. 9 in.; with a deadweight carrying capacity of 1,000 tons. The engines have been built by the North-Eastern Marine Engineering Co. Limited, Wallsend-on-Tyne, and are on the triple-expansion system, capable of indicating 500 H.P., and propelling the vessel at a speed of nine knots loaded. She is fitted with a patent steam windlass by Emerson, Walker & Co. During construction the vessel has been superintended by Captain Gregory A. Petrenko. She will be employed in the Black Sea coasting trade, for which she has been specially adapted, and will be the first screw steamer registered at the port of Keherson, Russia. As the vessel left the ways she was named the *Cossack* by Madame Petrenko.

Monrovia.—On Wednesday afternoon, March 5th, Messrs. Raylton, Dixon & Co. launched from their No. 2 dockyard a steel screw steamer built for Messrs. Elder, Dempster & Co., of Liverpool. This vessel is built on the raised quarter-deck principle, having a continuous bridge deck, forming a partial awning deck. Dimensions:—Length, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight capacity of about 3,600 tons. Her engines, which will be fitted by Messrs. Thos. Richardson & Son, of Hartlepool, are of 190 N.H.P., with cylinders 22in., 35in., and 59in. by 39in. stroke. On leaving the ways the vessel was christened *Monrovia* by Mrs. Bindesboll.

Fairmead.—On March 6th a new screw steamer was launched from the slipway of Messrs. Turnbull & Son's premises, Whitehall, Whitby. The name accorded to the new steamer was *Fairmead*, and the following are her dimensions:—Length, over all, 298 ft. 9 in.; length, between perpendiculars, 288 ft.; breadth, 38 ft. 2 in; depth, 19 ft. 9in. She is classed 100 A1 at Lloyd's; deadweight capacity about 3,440 tons, at 20·3½. Her engines are by Blair & Co., of Stockton, direct-acting triple-expansive; diameters of cylinders, 22 in., 36 in., and 59 in., with a stroke of 39 in.; N.H.P., 175. She is fitted with Emerson, Walker & Co.'s patent combination windlass. She has been built to the order of Messrs. Turnbull & Son, Whitby.

Lizzie Cory.—On March 6th Messrs. R. Irvine & Co., of West Hartlepool, launched a steel screw steamer measuring 231½ ft. length over all, 32 ft. breadth, and 22 ft. depth, moulded. She is to the order of Messrs. J. S. Allison & Co., of West Hartlepool, and will take Lloyd's highest class. She is a well-decker, with triple-expansion engines of 550 I.H.P., supplied from Messrs. Gray & Co.'s Central Works. The boiler is of steel, and capable of working at a pressure of 160 lbs. She is fitted with patent combination windlass by Emerson, Walker & Thompson Bros., Limited. She was named *Lizzie Cory*.

Douglas Hill.—On March 6th there was launched from the Howdon yard of Messrs. Palmer & Co. a steel screw steamer of the following dimensions:—Length, 285 ft.; breadth, moulded, 39 ft.; depth, moulded, 21 ft. 4 in. The vessel, which has been built to the order of Messrs. Evan Thomas & Co., Cardiff, is intended for general cargo purposes. She will be classed 100 A1 at Lloyd's under special survey, and guaranteed to carry 3,065 tons deadweight on Lloyd's summer freeboard. The vessel was named the *Douglas Hill*. The engines, to be supplied by the builders, are to be of the latest improved type, and capable of propelling the vessel at a high rate of speed. She is fitted with Emerson, Walker & Co.'s direct steam windlass, and has Wasteneys Smith's patent stockless anchors, stowing up hawse pipes.

Pak Ling.—On March 6th Messrs. Joseph L. Thompson & Sons launched from their shipbuilding yard, North Sand, Sunderland, a steel steamer, built to the order of the China Shippers' Mutual Steam Navigation Co., Limited, London. The vessel is of the following dimensions, viz.:—378 ft. in length, 41 ft. 6 in. beam, and 25 ft. 3 in. depth of hold, having a measurement capacity of over 5,000 tons. The engines, of the triple-expansion type, have been built by Mr. John Dickinson, of Palmer's Hill Engine Works, Monkwearmouth, and are of 2,800 I.H.P. The vessel was named the *Pak Ling*.

Enchantress.—On March 6th Messrs. Short Bros. launched from their yard at Pallion a steel screw steamer, built to the order of Messrs. Taylor & Sanderson, of Sunderland. Her principal dimensions are:—Length, 292 ft.; breadth, 40 ft.; depth of hold, 27 ft. 6 in. She was named the *Enchantress*. The vessel is to be fitted with quadruple-expansion engines by Messrs. Allan & Co., of Sunderland, and carries patent steam windlass in forecastle.

Benedick.—On March 7th Messrs. Bartram, Haswell & Co. launched from their shipbuilding yard at Sunderland a large steel screw steamer for Messrs. C. Howard & Son, of Leadenhall Street, London. The following are the principal dimensions:—Length, 300 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 7½ in., with a gross tonnage of 2,460 tons. The engines are by Mr. John Dickinson, and are of 1,150 I.H.P., the boilers being made of steel, to work at 160 lb. pressure. The vessel was named the *Benedick*.

Montebello.—On March 7th Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length, over all, 297 ft.; breadth, extreme, 35 ft.; depth, moulded to awning deck, 25 ft. 9 in. This steamer, which has been built to the order of Messrs. Thos. Wilson, Sons & Co., of Hull, and intended for their passenger trade between Hull and Norway, is classed 100 A1 at Lloyd's, and has been built under special survey. The awning deck extends fore and aft, on which amidships a large deck-house has been erected, containing dining saloon for 70 first-class passengers, &c. These passengers will be berthed in 'tween decks amidships. Accommodation aft will be provided for about 20 second-class passengers with saloon, &c. A large number of emigrants will also be accommodated in main and lower 'tween decks. The vessel has a cellular bottom fore and aft, will be provided with four steam winches, steam windlass, and extra large donkey boiler. All passenger accommodation, emigrants 'tween decks, officers', and crew's quarters, will be heated by steam, and steam pipes will be led into all cargo spaces in case of fire breaking out. She will also be fitted with electric light, and altogether as a first-class passenger steamer. She has extremely fine lines, and is intended to attain a high rate of speed, and will be engined by Messrs. Amos and Smith, of Hull. She was christened the *Montebello* by Mrs. H. G. Spence.

Sea King.—On March 8th Messrs. W. Doxford & Sons launched from their yard, at Pallion, a beautifully-modelled steamer, built to the order of Messrs. W. Ross & Co., of East India Avenue, London. The vessel is of steel, with cellular bottom fore and aft, to Lloyd's 100 A1 class, and her dimensions are—Registered length, 365 ft.; breadth, extreme, 44 ft.; depth, moulded, 30 ft. The engines are the ordinary triple-expansion three crank, by Messrs. Doxford, the cylinders being 27 in., 44 in., 72 in. by 48 in. stroke, supplied with high pressure steam from two double-ended boilers, which will give a mean speed of 10½ knots loaded. She is fitted throughout with electric light by J. H. Holmes & Co., Newcastle; steering gear amidships by Bow, McLachlan & Co., Paisley; screw gear aft by Crawford Bros., Monkwearmouth; steam windlass by Emerson, Walker & Thompson Bros., Gateshead, and five 7 in. by 12 in. winches by Welford Bros., of Pallion. The captain is housed in the poop aft, where there are also 12 berths for first-class passengers, of polished hardwood, neatly upholstered in best style by J. C. Calvert, of Sunderland. The officers and engineers are comfortably housed in the aft end of bridge, while the crew and firemen are berthed in the forecastle.

Bussorah.—On March 8th Messrs. W. Gray & Co., Limited, launched a steel screw steamer of the following dimensions, viz.: Length, over all, 300 ft.; breadth, 38 ft.; depth, 22 ft. 2 in.; built to the order of Thos. Appleby, Esq., West Hartlepool. She will class 100 A1 at Lloyd's, and has large internal and deadweight capacities. She has a poop containing handsome saloon and cabin for officers and a few passengers; long raised quarter-deck, and long bridge of extra strength. A large deck-house is built on the quarter-deck to give good accommodation for the engineers. The topgallant forecastle is fitted up for the crew, and has Emerson, Walker & Co.'s patent windlass on top. The hull is built on the web-frame principle, dispensing with hold beams and giving a clear hold for stowing cargo of the bulkiest description. Large hatchways are fitted, four steam winches, steam steering gear amidships and screw gear aft, two donkey boilers and double bottom under each hold for water ballast. The boats will be carried on beams overhead, and the vessel in every respect thoroughly equipped for general trading. First-class engines on the three cylinder triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. Working on three cranks they will develop over 950 H.P. The cylinders are 21½ in., 35 in. and 58 in. diameter, with a piston stroke of 39 in., and a constant supply of steam at a working pressure of 160 lbs. per square inch will be maintained by fine large steel boilers. The vessel was gracefully christened *Bussorah* by the Mayoress of West Hartlepool. The *Bussorah* is the eleventh vessel built by Messrs. W. Gray & Co., Limited, for the fleet of Messrs. Thos. Appleby & Co., and during construction she has been superintended by Captain Baker.

Time.—On March 8th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer, which has been built to the order of Messrs. Kinghorn Brothers, of Liverpool, agents for the owners, Messrs. Wm. Howard Smith & Sons, Limited, of Melbourne. The vessel will form a valuable acquisition to their already numerous fleet employed in the coasting trade of Australia. During construction both vessel and engines have been under the superintendence of Mr. J. G. Kinghorn, of Liverpool. The vessel is of the following dimensions, viz:—Length, 300 ft.; breadth, 41 ft.; depth, 23 ft.; and is built under Lloyd's special survey to class 100 A1 on the well-decked rule. This steamer has water ballast right fore and aft on the cellular system, and will be fitted with all modern improvements for the rapid loading and discharging of cargo, including two large donkey boilers, four double cylindered steam winches, and four steam whipping hoists, and has direct acting steam windlass, steam steering gear by Messrs. Muir & Caldwell, and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. Wigham Richardson & Co., are of the triple-expansion type, having cylinders 23 in., 37 in., and 62 in. by 42 in. stroke, combining all modern appliances for economical working. Steam is supplied by two large boilers, constructed throughout of steel and to Lloyd's requirements, and working at a pressure of 160 lbs. On leaving the ways the vessel was gracefully named *Time* by Miss Katie Clarke, of The Hermitage, Gateshead.

Ilimoff.—On March 8th Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Stockton, another petroleum tank steamer, being a sister ship to the *Petrolea*, launched a short time since, and which has been giving such excellent results. Her dimensions are as follows:—Length, 301 ft.; breadth, 37 ft.; depth, moulded to spar deck, 26 ft. The vessel has been built to the order of Alfred Suart, Esq., of London. She is divided into 13 compartments, and fitted with cofferdams to promote safety. Her bunkers are also arranged to carry oil as fuel, and she is built to the highest class in Lloyd's, under special survey. She is rigged as a three-masted schooner, and fitted with Pepper's steam steering gear; outfit of winches by R. Roger & Co., and patent steam windlass by Emerson, Walker & Thompson Bros. She has also steam cooking apparatus by Grieve & Gillespie. The engines have been constructed by Messrs. Westgarth, English & Co., Middlesborough, on the triple-expansion surface condensing principle, with cylinders 22 in., 35 in., and 57 in. diameter, by 39 in. stroke; two boilers, 17 ft. 6 in. by 10 ft. 9in. long, with three Purve's patent furnaces, with separate combustion chambers, working pressure 160 lbs. per square inch. She has also Kirkaldy's feed heater, yaryan evaporator, steam turning and reversing gear with steam brake; indicated power in ordinary working, 1,100 horses. The vessel is also fitted with very superior pumping arrangements, and a magnificent installation of electric light by Messrs. Hayward, Tyler & Co., hydraulic and electrical engineers, of London. The wiring is carried out on the "double wire" principle, and the wires are thoroughly cased and protected throughout. This vessel has been specially constructed so that she may carry cattle and also ordinary goods—her trunks being cut down by special design of the builders, so as to permit of ready loading and discharging of ordinary cargo. Her tanks have all been tested on the stocks on the usual extensive and important scale, and passed by Lloyd's surveyor. She has been built under the superintendence of Mr. Joseph Bissett, the owner's representative. This is the third vessel built by Messrs. Craig, Taylor & Co. for this special trade, and they have another larger one of similar class now on the stocks. Before gliding into the water she was gracefully christened the *Ilimoff* by Mrs. Herbert Taylor, of Wissahickon, Eaglescliffe, wife of the junior partner.

Oxus.—On March 8th there was launched from the yard of the Strand Slipway Co., North Sands, Sunderland, a steel screw steamer of the following dimensions and tonnage:—Length, between perpendiculars, 216 ft.; breadth, 28 ft. 3 in.; depth, 18 ft.; and about 910 tons gross register. The vessel has been built to the order of the Oxus Steamship Co., of London, and was named the *Oxus*.

Phidias.—On March 10th Messrs. R. & W. Hawthorn, Leslie & Co., Limited, launched from their shipyard at Hebburn, a large steel screw steamer for the Liverpool and South American trade. The vessel is 324 ft. by 42 ft. by 23 ft. The vessel, which has been built to the order of Messrs. Lamport & Holt, of Liverpool, was named the *Phidias*.

Beacon Light.—On March 10th there was launched from the Low Walker Yard of Messrs. Sir W. G. Armstrong, Mitchell & Co. a large screw steamer, built on Swan's patent, for the carriage of petroleum in bulk. The vessel is capable of carrying 4,200 tons deadweight, and was named the *Beacon Light*. She was taken to the works of the Wallsend Slipway and Engineering Co., where she will be fitted with machinery on the triple-expansion system. The vessel has been built for Messrs. R. Stewart & Co., of Liverpool.

Pallas.—Messrs. Edwards' Shipbuilding Co., Limited, have lately launched from their yard at Howdon-on-Tyne a new steel screw steamer, built to the order of Messrs. Fisher, Renwick & Co., Newcastle, for Messrs. Krogins, Helsingfors. The principal dimensions are:—Length, 212 ft.; breadth, 32 ft.; depth, moulded, 16 ft. The vessel was named *Pallas*.

Tresillian.—On March 19th there was launched from the shipbuilding yard of Messrs. J. Readhead & Sons, South Shields, a new screw steamer which has been built to the order of Messrs. E. Hain & Son, of St. Ives, Cornwall. Her principal dimensions are:—Length, 290 ft.; breadth, 40 ft.; and depth, 21 ft. She has a deadweight capacity of 3,650 tons, and her class will be 100 A1 at Lloyd's, special survey. The vessel is of the improved well-decked type, having poops, long raised quarter-deck, bridge amidships, and topgallant forecastle. She is provided with steam steering gear, direct-acting steam windlass, and all the latest appliances; and is also fitted with all the requirements of the Grain Cargoes Act. The engines, which are also built by Messrs. Readhead & Sons, are of the triple-expansion system, having cylinders of 23 in., 37½ in. and 61½ in., with a 39 in. stroke. Steam will be supplied from two boilers which will work at a pressure of 160 lbs. per square inch. The vessel, which is the twentieth built by Messrs. Readhead for the same owners, was named the *Tresillian* by the Mayoress of St. Ives.

Oria.—On March 20th there was successfully launched from the shipbuilding yard of Messrs. Robert Thompson & Sons, Southwick, Sunderland, a steel screw steamer, built to the order of Messrs. Bailey & Leetham, of Hull, and under the inspection of Mr. Thompson. Her dimensions are:—Length, 280 ft.; breadth, 38 ft. 10 in.; depth to Lloyd's floors, 19 ft. 6 in. She has a straight stem and elliptical stern, and is rigged as a two-masted schooner. Classed 100 A1. "Part awning deck," built under special survey, with cellular double bottom fore and aft. She has a short full poop, raised quarter-deck from poop to after end of engine-room, and part awning deck to stern. Accommodation is provided in the poop for the captain, steward, and twelve passengers. The officers and engineers are berthed amidships, just aft of the engine-room, and the forecastle is fitted up to accommodate the crew and firemen. The vessel has four large hatchways worked by powerful steam winches, and donkey boiler, steam steering gear, and direct steam windlass, together with all the latest improvements. The engines are by Messrs. George Clark, Limited, Southwick, and are tri-compound, having cylinders 21 in., 35 in. and 57½ in. by 39 stroke. The vessel was christened the *Oria* by Miss Thompson, of Hull.

Leon.—On March 20th the iron steamship *Leon*, built to the order of Mr. Helvonsen, of Bergen, was launched from the yard of Messrs. Allsup & Co., near Preston. She is 206 ft. long, 28 ft. beam, and 19 ft. depth. Her engines are of the triple-expansion type, with cylinders 17 in., 26 in., and 42 in., by 30 in. stroke, capable of driving the vessel at a speed of 11 knots. She is intended for the South American fruit trade, and she is fitted up to carry a few passengers. This is the largest vessel ever launched on the river Ribble.

Hounslow.—On Friday, March 21st, Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length over all, 324 ft.; breadth, 40 ft. 6 in.; depth, 23 ft. 8½ in.; built to the order of Messrs. Watts, Ward & Co., London, and to class 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop containing saloon and cabins for officers and a few passengers, long raised quarter-deck, long bridge of extra strength to fore hatch, and containing crew's quarters at fore end and engineers' berths aft, and open topgallant forecastle with Emerson, Walker & Co.'s direct steam capstan windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for stowing bulky cargo. Large hatchways are fitted; four steam winches, steam steering gear amidships, screw steering gear aft, two donkey boilers, and cellular double bottom throughout for water ballast. The rig will be schooner, with double foretopsails and topgallant sail. The boats will be carried overhead on beams, and a full equipment of modern appliances provided for general trading. The engines are on the three cylinder triple-expansion principle. The hull and machinery are being superintended by Captain J. A. Hodgson and Mr. A. H. Alchin respectively on behalf of the owners. The christening ceremony was gracefully performed by Miss Betts, of Highbury Hill, London, the vessel being named *Hounslow*.

Florence Petherick.—On March 21st a wooden sailing vessel named the *Florence Petherick* was launched from the yard of the Duddon Shipbuilding Co., at Millom. She is 90 ft. long, 22 ft. beam, and 10 ft. deep, with a carrying capacity of 200 tons, and has taken two years to construct. She has been bought by the Hodbarrow Mining Co., Limited.

Cacoman.—On March 22nd Messrs. Ritson & Co., Glasson, Maryport, launched from their shipbuilding yard a handsome four-masted iron sailing ship named the *Cacoman*. She is 2,000 tons register, with a deadweight carrying capacity of 3,200 tons, and is 185 ft. long, 39 ft. 6 in. in beam, and 21 ft. 6 in. depth. The *Cacoman* is fitted with the steam winch, with messenger for working the windlass, and has steel lower mast and topmast in one with steel lower yards.

Calabro.—On March 24th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a finely-modelled steel steamer, built to the order of the Puglia Steam Navigation Co., of Bari, Italy. The principal dimensions of the vessel are:—Length, 295 ft.; breadth, extreme, 38 ft.; depth, moulded, 26 ft. 9 in. The vessel is built to take the highest class at Lloyd's, spar deck grade, and has a long poop fitted with accommodation for about 60 first-class passengers, and bridge amidships, under which is accommodation for captain and officers, and top-gallant forecastle for crew. The vessel has three complete decks laid; the first 'tween decks are exceptionally high, and have side lights all fore and aft, and is to be fitted with 750 galvanised iron beds for emigrants; large cooking ranges are fitted on deck, doctor's shop, and all accessories for the large number of passengers which she will carry. The deck machinery consists of direct steam windlass, steam winches, steam steering gear, and large donkey boiler, all by Messrs. Clarke, Chapman & Co., of Gateshead. Triple-expansion engines by the North Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, will be fitted, having cylinders 23½ in., 39 in., and 64 in. diameter, by 42 in. stroke; two large boilers working at a pressure of 160 lbs., steam steering gear, and all details of a first-class engine are supplied. The hull and machinery have been built under the inspection of the Board of Trade, and will be supplied with their certificate for passengers. Upon leaving the ways the steamer was gracefully named *Calabro* by Miss Brunson, of Dublin.

LAUNCHES.—Scotch.

Clacton Belle.—On February 26th Messrs. Wm. Denny & Bros., Dumbarton, launched a fast paddle-steamer of 450 tons gross register for the London, Woolwich, and Clacton-on-Sea Steamboat Co., Limited. The steamer is being fitted with all the latest improvements, including steam windlass and steam steering gear, a large deck saloon the full width of ship aft for first-class passengers, dining saloon below main-deck for first and second class passengers, and a large promenade deck extending from foreside of bridge to the stern over the deck saloon. As the vessel left the ways she was named the *Clacton Belle* by Miss Penfold, daughter of the chairman of the company. The *Clacton Belle* is intended for the passenger trade between London and Clacton-on-Sea.

Vauban.—On March 4th there was launched from the shipbuilding yard of Messrs. William Hamilton & Co., Port-Glasgow, a steel screw steamer, named the *Vauban*, of the following dimensions, viz.:—254 ft. by 34 ft. by 22 ft. 6 in., moulded. This steamer has been built to the highest class at Lloyd's and French Bureau Veritas, specially designed to carry a large cargo on a light draft, and is fitted with all the latest modern improvements. She has accommodation in house on deck aft and under the bridge for sixteen first-class passengers. This steamer has been built to the order of Messrs. Maurel & H. Prom, of Bordeaux, for their special trade between France and the Senegal, and is the fifth steamer built by Messrs. Hamilton for the same firm. She will be fitted with triple-expansion engines by Messrs. Blackwood & Gordon, capable of giving a speed of eleven knots.

Simla.—On March 5th Messrs. Russell & Co. launched from their Kingston Yard, Port-Glasgow, a four-masted steel sailing barque of 2,200 tons net register, to carry 3,600 tons on Lloyd's freeboard. Dimensions:—Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 3 in. This vessel is sister ship to the *Stanley*, launched some months ago by Messrs. Russell & Co. for the same owner, Mr. G. M. Steeves, Liverpool. The vessel, which is named *Simla*, will fit out in the James Watt Dock, and will load at Liverpool for Calcutta. The builders will put down the keel of a vessel of similar dimensions on the vacated ways.

Ptarmigan.—On March 6th a steel screw steamer, named the *Ptarmigan*, for the Cork Steamship Co., Limited, was launched from the yard of Messrs. W. B. Thompson & Co., Dundee. The following are the vessel's dimensions:—Length, between perpendiculars, 256 ft.; breadth, moulded, 32 ft.; depth of hold, 15 ft. 8 in. She has been built in excess of the highest class at Lloyd's, and is intended for the general trade of the company, but could also, if occasion requires, be fitted up for the conveyance of cattle. As in the other vessels of the company, the *Ptarmigan* has been built on the cellular-bottom principle. The poop deck extends to the fore end of the boiler hatchway, and under the after-way accommodation has been provided for the officers and engineers in large and roomy quarters. The space under the bridge deck amidships is wholly occupied by the cabin, containing captain's room and accommodation for ten first-class passengers. The appliances for loading and discharging the cargo are very complete, and comprise four powerful steam cranes and two steam winches. The engines and boilers are from Messrs. Thompson's Tay Foundry, the engines being of the triple-expansion type, with cylinders 21 in., 34 in., and 55 in. diameter, with 42 in. stroke. Steam is supplied from two steel boilers at a pressure of 160 lbs., that for the cranes, winches, &c., being supplied from a donkey boiler on the main deck, and she is fitted with Wasteneys Smith's patent stockless anchor. The *Ptarmigan* is the sixth vessel built by the Messrs. Thompson for the Cork Steamship Co.

Lien Shing.—On March 10th the London and Glasgow Engineering and Iron Shipbuilding Co., Limited, launched from their shipbuilding yard at Govan the *Lien Shing*, a steel screw steamer built to the order of the Indo-China Steam Navigation Co., Limited. The dimensions of the vessel are:—250 ft. by 36 ft. by 21 ft. 6 in. depth of hold, and she has been specially constructed for the China coasting trade. The engines, also supplied by the builders, are of the triple-compound type, having cylinders 20 in., 32 in., and 52 in. diameter, by 39 in. stroke. The boilers are two in number, the working pressure being 160 lbs. The *Lien Shing* has accommodation for first and second class passengers, and is provided with all necessary appliances for the speedy loading and discharging of cargo.

Managua.—On March 10th the Grangemouth Dockyard Co. launched from their shipbuilding yard at Grangemouth a steel screw steamer of the following dimensions, viz:—Length, 175 ft. between perpendiculars by 28 ft. by 12 ft. 5 in. to main deck and 19 ft. 5 in. to awning deck. She will be fitted up for a number of first-class passengers, and with all the latest improvements for working both ship and cargo. She was named the *Managua* by Mrs. Frus, the wife of Captain Früs, who will command the vessel, and who has superintended her building on behalf of the owners. The *Managua* is built to the order of Johann C. Giertsen, of Bergen, and is intended for the fruit trade between New York and the West Indies, for which purpose she has been specially designed. The engines, which are being constructed by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow, are of the latest triple-expansion type, and are expected to drive the steamer at a high rate of speed. She is built to highest class at Norwegian Veritas, and under the special survey of Mr. Stuve, resident surveyor in Scotland. This makes the third steamer which the Dockyard Co. have launched this year for the same trade.

Brazil.—On March 12th Messrs. J. & G. Thomson, Clydebank, launched a steamer named *Brazil*, built for the Brazilian Steam Navigation Co., Rio de Janeiro. The *Brazil*, which is 2,000 tons, and has engines of 2,400 H.P., is 282 ft. long by 38 ft. by 22 ft. She is the fifth steamer built by Messrs. Thomson for the same owners, and is fitted with all the latest improvements suitable for a tropical climate. The construction of the vessel has been superintended by Mr. Elijah Robinson, senior engineer of the company, assisted by Mr. Macfarlane. The vessel is intended for traffic on the coast of Brazil.

Rio Paraguay.—On March 12th Messrs. Murdoch & Murray, Port-Glasgow, launched a steel screw steamer of the following dimensions:—Length, 160 ft.; breadth, 33 ft.; depth, 9 ft.; tonnage, 430 tons gross. This vessel is named the *Rio Paraguay*, and is a sister ship to the *Pilcomayo*, launched by the same builders last month. The machinery—consisting of two sets of triple-expansion engines, cylinders 9 in., 18 in., and 32 in. by 22 in. stroke, 340 H.P.—will be fitted on board at Greenock by Messrs. Rankin & Blackmore. During construction the vessel has been under the supervision of Messrs. Morton & Williamson, Glasgow.

Melete.—On March 13th a steel sailing ship named *Melete* was launched from the yard of Messrs. Charles Connell & Co., Scotstoun, near Glasgow. The vessel, which is for Hamburg owners, is of the following dimensions:—Length, between perpendiculars, 256 ft.; beam, 40 ft.; depth of hold, 23 ft., and the tonnage is 1,780 tons.

Highland Chief.—On March 20th Messrs. Alex. Stephen & Sons launched at Linthouse a fine steel screw steamer of about 2,700 tons, and highest class in Lloyd's. The vessel, which is for Messrs. Jas. Nelson & Sons, Liverpool, was gracefully named the *Highland Chief* by Miss D. Young, 8, Claremont Terrace. The *Highland Chief* has triple-expansion engines, with cylinders 23 in., 37 in., and 59 in. diameter, by 42 in. stroke, and three steel boilers suitable for 160 lbs. pressure—all fitted on board complete before launching, and is fitted with all the most improved and efficient appliances alike for navigation and for work in port. Being specially intended for the frozen meat trade, the ship carries suitable refrigerating machinery, and meat-holds, capable of carrying carcases of 100,000 sheep, will be thoroughly insulated on the most approved principles. 'Tween decks are also arranged for carrying live cattle. The construction of the *Highland Chief* has been superintended by Messrs. Wm. Esplen & Son, Liverpool, whose large experience has been utilized in the special fittings for the intended trade; and the vessel is to be commanded by Captain James I. Black.

Corsican.—On March 20th Messrs. Mackie & Thomson, Govan, launched the *Corsican*, a screw steamer of 348 tons gross, built to the order of Messrs. J. M'Farlane & Co., Glasgow, and intended for the Irish fish trade. Her dimensions are:—Length, 155 ft.; breadth, 33 ft. 6in.; depth, 12 ft. She will be fitted by Messrs. Muir & Houston with triple-expansion engines of 450 I.H.P.

Claudine.—On March 20th there was launched from the yard of Messrs. Napier, Shanks & Bell, Yoker, a steel screw steamer, named *Claudine*, of about 850 tons gross, built to the order of Mr. Claus Spreckles, of San Francisco and Honolulu, for passenger and cargo service at the Hawaiian Islands. She has been constructed to the highest class of Bureau Veritas, has long poop, monkey forecastle, and large deck-houses forward and aft of machinery space, with shade deck overhead. Accommodation is provided in poop for about 60 first-class passengers. The vessel is fitted throughout in the highest style with electric light, electric bells, &c.

Hyppolyto Dumois.—On March 20th there was successfully launched from the shipbuilding yard of Messrs. T. B. Seath & Co., Rutherglen, a screw steamer built to the order of Messrs. Curwen Bros., Liverpool, and intended for the fruit trade between North America and the West Indies. Her dimensions are:—Length, 175 ft. by 28 ft. beam; depth, 18·3 ft. to awning deck. She will be fitted with triple-expansion machinery by Messrs. Hutson & Corbett, engineers, Glasgow, and it is expected will attain a speed of 12 knots an hour. As she left the ways she was named the *Hyppolyto Dumois*, after the principal partner of the firm chartering the steamer for the trade in which she will be engaged.

LAUNCHES—Irish.

Minnie Hinde.—On February 20th Messrs. M'Ilwaine & M'Coll launched from their shipyard in Belfast a steel screw steamer, built to the order of Mr. Wm. Hinde, of Belfast. The vessel was named the *Minnie Hinde*, after the owner's daughter. The vessel's dimensions are:—Length, 180 ft.; beam, 27 ft.; depth of hold, 13 ft. 4 in. She is built almost entirely of steel, under special survey of Lloyd's for their highest class. The vessel is for the Belfast and Whitehaven service.

Chichester.—On February 22nd there was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Limited, Belfast, a new screw steamer, built for Mr. Wm. R. Rea, 19, Donegal Quay, Belfast. As the vessel left the ways she was named the *Chichester*. Her dimensions are:—Length, between perpendiculars, 285 ft.; breadth, moulded, 38 ft.; depth, moulded, 22 ft. 2 in. She is a "well-deck" steamer, built of steel, and is to be classed 100 A1 in Lloyd's register, with a special survey mark attached. She has a topgallant forecastle forward, short well at forward hatch, long bridge deck, and a raised quarter-deck aft. The decks are steel, with the exception of the forecastle head, which is of wood. The machinery is of the triple-expansion type, and will develop 1,000 I.H.P. The deadwieght carrying capacity of the new ship will be upwards of 3,200 tons.

LAUNCHES—Flushing.

Hektos.—On February 27th a new cargo steamer built for the Flensburg Steamshipping Co. of 1869 was launched by the Flensburg Shipbuilding Co. This steamer is the tenth built for this company. She has dimensions, 240 ft. by 34 ft. by 17 ft., and will be fitted with triple-expansion engines of 550 H.P., also built by the Flensburg Shipbuilding Co. As she left the ways she was christened *Hektos* by Miss Detlefsen.

TRIAL TRIPS.

Desdemona.—On February 8th a new fine passenger steamer, built by the Flensburg Shipbuilding Co. for the Hamburg Pacific Line, made her trial trip. This boat has the following dimensions:—Length, 323 ft.; breadth, 40 ft.; depth, 29 ft.; and has a beautiful model. Accommodation for 30 first-class passengers in the poop aft, fitted in a very elegant style. With her triple-expansion engines, 1,600 H.P., the average speed was 13½ knots. The *Desdemona* is a sister ship to the *Cleopatra*, which was delivered to the same owners in December last year.

Orel.—On February 24th the trial trip of the new twin-screw steamer *Orel*, built and engined by Messrs. R. and W. Hawthorn, Leslie & Co., Limited, took place off the Tyne. This vessel is said to be the fastest mercantile steamer yet built on the North-East Coast. The rate of speed guaranteed was 18 knots an hour under forced draught, and this was undertaken, not on a light draught of water, but with a heavy cargo on board. On the trial, with all her lower holds filled with coal, the run north showed 18·782 knots, and the run south 17·56, giving a mean of 18·17 knots per hour with ordinary draught. Under forced draught an extra knot and a-half was obtained, making over 19½ knots per hour. The dimensions of the *Orel* are:—Length, 440 feet; over all, 452 feet; breadth of beam, 48 ft.; and depth, moulded, 35 ft. She is fitted with two sets of triple-expansion engines, having cylinders 34 in., 54 in., and 85 in., by 51 in. stroke. The engines indicated on trial about 10,000 H.P. Twin screws have been adopted so as to give double protection in case of accident. The vessel is built above Lloyd's highest class throughout, of Siemens-Martin steel.

Hornby Grange.—On February 25th this steamer, built and engined by Messrs. Wigham, Richardson & Co., for Messrs. Holder Brothers, London, under the superintendence of Messrs. Flannery, Baggallay & Johnson, London, was taken for trial. The hull and machinery have been completed some weeks, and she has been lying at the builders' yard, being insulated for frozen meat cargoes, in which trade she will run. She is 300 ft. by 40 ft. by 23 ft. Her main engines have cylinders 24 in. 37 in. and 62 in. in diameter, by 42 in. stroke; her boilers, which are of large power, have a heating surface of about 6,000 square feet. The deck fittings are designed with a view to quick handling and discharging by means of six winches, and include special fittings for handling meat cargoes. Cold-air is supplied to the holds by two sets of compound condensing engines placed in the 'tween decks, which are specially built for the purpose, and are supplied with steam from any of the boilers. She carries apparatus for distillation, both for cattle service and for use upon the main boilers at sea. The ship is fitted throughout with electric light, the masthead and side lights being in duplicate, and lights being run in the holds and bunkers, with large cargo lights for discharge at night time. Trial was made under reduced power, the speed attained being over 10 knots. The machinery worked throughout without the slightest hitch.

Mira.—On February 25th the steel cargo steamer *Mira*, built by the Flensburg Shipbuilding Co. for Messrs. Holm & Molzen, made her first trial. Her dimensions are:—Length, 217 ft.; breadth, 31 ft.; depth, 17 ft.; 500 H.P. triple-expansion engine. She is built of German steel to first division at Bureau Veritas. Her average speed with a very low consume of coals was 11½ knots.

Thames.—On February 26th the preliminary trial of the new steamship *Thames* was made on the Clyde. This is the third of four steel screw steamers of about 5,500 tons built by Messrs. R. Napier & Sons for the Royal Mail Steam Packet Co., London. These vessels have been specially designed to meet the requirements of the company's West Indian, Brazil, and River Plate services, and in order to obtain a high rate of speed with the greatest economy, the hulls have been constructed upon fine lines, and a handsome clipper bow and figurehead give the vessels a most symmetrical appearance. This is enhanced by a smart rig and two well-proportioned funnels, the whole conducing to make one of the best specimens of naval architecture produced upon the Clyde. The general dimensions of the *Thames* are as follow:—Length over all, 456 ft.; breadth, extreme, 50 ft.; depth to spar deck, 33 ft. 4 in.; with a gross tonnage of about 5,500 tons. The vessel is built of steel, classed A1 at Lloyd's under special survey, and to meet the Admiralty requirements for armed cruisers. The machinery consists of powerful triple-expansion engines, fitted with all the most modern improvements, and capable of indicating 7,000 horse-power, steam being supplied by eight single-ended boilers with a working pressure of 150 lbs. to the square inch. The accommodation for the passengers is of the most sumptuous and complete description, and all the details have been carefully considered with special reference to a first-class passenger service in a hot climate. This consists principally of a dining saloon, music-room, ladies' boudoir, smoking-room, and state rooms for about 200 first-class passengers, a dining saloon, ladies'-room, smoking-room, and state rooms for 40 second-class passengers, with ample and comfortable accommodation for 500 third-class passengers. The result of the preliminary trial was very satisfactory, and the ship afterwards proceeded to Southampton for the official trials at Stokes Bay. The *Thames* passed, on March 4th, her official trials at Stokes Bay. The mean speed was 17½ knots per hour, and as this result (half a knot over the contract speed) was easily obtained with a plentiful supply of steam and a total absence of heating, the ship's performance was considered highly satisfactory.

Rosneath.—On February 26th the screw steamer *Rosneath*, built by Messrs. Murdoch & Murray, Port-Glasgow, went down the Clyde on her trial trip. After adjusting compasses in the Gareloch the vessel proceeded to the measured mile at Skelmorlie, and after running over the mile it was found that the average speed was 11 knots. The vessel is 260 ft. long by 37 ft. broad by 19 ft. 6 in. deep, and had on board a cargo of 1,660 tons at the time of trial, so that the speed was considered by all parties on board to be in excess of what was expected. The owners are Messrs. P. H. Dixon & Harrison, of Glasgow, and the engines, which are triple-expansion, have cylinders 19 in., 32 in. and 52 in. diameter by 39 in. stroke, and indicated 1,183 H.P. These were made by Mr. William Kemp, engineer, Glasgow. After the party went ashore, the vessel proceeded on her voyage to Spain.

Rostrevor.—On February 28th the s.s. *Rostrevor*, built by Messrs. J. Fullerton & Co., Merksworth Building Yard, Paisley, went down the Clyde on her trial trip. Compasses having been adjusted, a select party of the directors and their friends, with Mr. Walter Chambers, engineer, Belfast, under whose inspection the steamer was built, went on board at Gourock. Several runs were then made on the measured mile at Wemyss Bay, a speed of 10½ knots being attained, which was considered highly satisfactory by the owners. The engines, which were supplied by Mr. William Kemp, Govan, worked all day in the most satisfactory manner. The *Rostrevor* has been built to the order of the Newry and Kilkeel Steamship Co., and is intended for the Channel trade. She proceeded up to Glasgow in the evening to load for Newry.

Naparima.—On March 1st the screw-steamer *Naparima*, which has been built by Edwards' Shipbuilding Co., Howdon, for Messrs. Caw, Prentice & Clapperton, Glasgow, went to sea for her trial trip. The vessel is a cargo steamer of about 2,500 tons deadweight capacity. The machinery, of the triple-expansion type, is of about 900 I.H.P., and has been constructed by the North-Eastern Marine Engineering Co., Wallsend. During the trial, which was made in exceedingly rough weather, the engines ran without any stoppage or hitch of any kind.

Stanley Force.—The screw-steamer *Stanley Force*, recently launched by Messrs. R. Williamson & Son, Workington, for Messrs. Kennaugh & Co., Whitehaven, went recently on her speed trials on the Clyde, where she has had her propelling machinery fitted on board by Messrs. Dunsmuir & Jackson, Govan. These engines are of the triple-expansion type, having cylinders 14½ in., 20 in., and 33 in. in diameter, respectively, by 24 in. stroke. Steam is supplied from one steel boiler 11 ft. 3 in. in diameter by 9 ft. long, having a heating surface of 1,044 sq. ft., and a grate area of 33 sq. ft. Working under a steam pressure of 160 lbs. to the square inch, and with the engines running at 112 revolutions, the power developed was 450 I.H.P. The mean speed on the measured mile in the Garloch was 10·8 knots.

Aud.—The new steamer *Aud*, recently launched by the Grangemouth Dockyard Co., from their yard at Alloa, recently went on her speed trials on the Firth of Forth, when her machinery worked satisfactorily. It was constructed by Messrs. Alley & Maclellan, of the Sentinel Works, Glasgow, and consists of triple-expansion engines, having cylinders 14 in., 23 in., and 38 in. in diameter respectively, with a piston stroke of 28 in. The cooling surface in condenser is 700 sq. ft. Steam is generated in one steel boiler 12 ft. 9 in. in diameter by 10 ft. long. The heating surface is 1,112 sq. ft., and the grate area 54 sq. ft. With steam at 160 lbs. pressure, and the engines 500 I.H.P., the speed attained on the measured mile was 10 knots.

Mexico.—On March 4th the trial trip of the new steamer *Mexico*, built by the Grangemouth Dockyard Co., took place on the Firth of Forth Her dimensions are 178 ft. by 25 ft. by 11½ ft. to main deck, 18½ ft. to awning deck. Her engines, which are the triple-expansion type, were supplied by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow. Cylinders 16 in., 26 in., and 40 in., by 30 in. stroke, and supplied with steam at 160 lbs. pressure. On a trial of speed with the vessel loaded an average of 11 knots was obtained, being half a knot over the guaranteed speed. The *Mexico* has been built to the order of Messrs. Romano & Co., of Tobasco, Mexico, and is handsomely fitted up for 40 first-class passengers. Clark, Chapman steam winches and steam windlass; and Alley & Maclellan's steam steering gear. Throughout the engines worked smoothly and to the satisfaction of all those interested.

Jane Radcliffe.—On March 4th the screw steamer *Jane Radcliffe*, recently launched from the Howdon yard of the Palmer Co., was taken out on her trial trip. The vessel is 260 ft. in length, 37 ft. broad, and 19 ft. 4 in. deep, and is built to carry a deadweight cargo of 2,700 tons. The vessel, which is of steel, with iron decks, is built on the well-decked principle, is schooner-rigged, and her construction and fittings considerably exceed those required to class 100 A1 at Lloyd's. For a cargo boat she is fully fitted up with every appliance, including Clark, Chapman & Co's winches and direct-acting steam windlass. The accommodation for the captain and officers is in a sunk poop aft, and for the seamen and stokers in front of the long bridge. The standard compass is that of Sir Wm. Thomson. The engines, which were supplied by the Palmer Co., are of the triple-expansion type, the diam. of the cylinders being 20 in., 33 in., and 54 in., with a 36-in. stroke, and a working pressure of 160 lbs. During the trial they worked smoothly and satisfactorily, the speed being an average of 11 knots an hour. The vessel has been built to the order of Messrs. Evan Davis, Radcliffe & Co., Cardiff, and is the tenth ship built for the firm by the Palmer Co., the whole of the previous vessels being still afloat and doing well, and the eleventh is now being built in the Howdon yard.

Messapia.—On March 4th the screw steamer *Messapia* left Sunderland on a trial trip. The vessel, a passenger and cargo steamer, has been built by the Sunderland Shipbuilding Co., Limited, Sunderland, for the Puglia Steam Navigation Co., Bari, Italy, and is of the following dimensions:—Length, 275 ft.; breadth, 38 ft.; draft, 19 ft. The machinery consisted of a powerful set of triple-expansion engines, constructed by the North-Eastern Marine Engineering Co., Wallsend. During the trial, several runs over the measured mile were taken, with the vessel fully laden with 2,400 tons of coal, and a mean speed of 11½ knots was obtained, being half a knot in excess of the guaranteed speed. The machinery throughout worked beautifully, and without any hitch.

Coleridge.—This fine vessel, which is now owned by Messrs. Lamport & Holt, has been laid up for some time having new triple-expansion machinery fitted by Messrs. David Rollo & Sons, of Fulton Engine Works, Liverpool. Messrs. Rollo have also given a very complete renewal to all parts of the hull in the machinery space and deck-houses, while Messrs. Howson & Co. have effected great improvement on her saloon, having also added considerably to the deck accommodation. The vessel has been fitted with a refrigerating machine by Messrs. Kilburn & Co., while an electric lighting plant has been fitted by Messrs. Holmes, of Newcastle. The main engines, which are Messrs. Rollo & Sons' usual type, are on the three cylinder three crank arrangement, having all the pumps worked by links and levers from the centre engine. The cylinders are 25 in., 39 in., and 62 in. in diameter respectively, having a stroke of 48 in., and they are fitted with double eccentric valve gear. Steam of 160 lbs. pressure is supplied by two double-ended steam boilers, having a heating surface of over 6,000 square feet. On Thursday, March 6th, the vessel proceeded on her official loaded trial trip, when her machinery was fully tested, and gave every satisfaction. On ordinary running the vessel is intended to average 12½ knots on 1,500 I.H.P., burning 24 tons of coal, and from her performance on Thursday this will be fully realised. After the trials the ship left the Mersey for Antwerp, from which port she sails with the mails for Monte Video on the 15th inst.

Umbilo.—On March 7th the *Umbilo*, a passenger and cargo steamer, built by Messrs. Wm. Gray and Co., Limited, West Hartlepool, went on her official trip off the Hartlepools. The vessel is 280 ft. long by 37 ft. 6 in. broad by 24 ft. deep, and carries about 2,600 tons deadweight. She is furnished with a full Board of Trade passenger certificate. She also takes Lloyd's highest class. The vessel is built to the order of Messrs. Bullard, King & Co., London, and is intended to augment their African line of steamers running between London and Natal. The engines were manufactured at the Central Marine Engineering Works of Messrs. William Gray and Co., Limited, and are of the size designated 1,000 I.H.P. by the builders, having two steel boilers working at 150 lbs. pressure per square inch. The engines were put full speed ahead, and kept running at a speed of 80 revolutions per minute for two hours, with the result that the speed of the ship was found to be a little over 12¼ knots per hour, everything in the engine-room working to perfection. This vessel has been provided with a propeller of the usual special type, manufactured at the Central Marine Engine Works, but cast in manganese bronze, instead of cast iron. A special furnace has recently been erected at the Central Engine Works, for the sole purpose of casting propellers in this metal, which, it is stated, give an advantage in speed of something like half a knot per hour. The builders of this steamer have now on order another and larger vessel for the same owners and the same trade, which also will be fitted with a manganese bronze propeller.

Harewood.—On March 8th the screw steamer *Harewood*, recently launched from the Jarrow yard of Messrs. Palmer & Co., was taken out to sea on her trial and compass-adjusting trip. The dimensions of the vessel are as follows:—Length, between perpendiculars, 312 ft.; breadth, 40 ft., moulded; and depth, 27 ft. 5½ in. The vessel has a carrying capacity of 4,200 tons deadweight. She has been built to the order of Mr. W. Wright, of London, and is intended for the Indian and China trade. She has been constructed under the superintendence of Mr. John Runciman, of the firm of Walter Runciman & Co., of South Shields. Her engines were constructed by Messrs. Palmer & Co., under the superintendence of Mr. Menzies, of the firm of Wm. Menzies & Co., of Newcastle. A mean speed of 12 knots an hour was attained at the trial.

Armenia.—On March 8th the *Armenia*, a cargo vessel, carrying 3,450 tons deadweight, built by Messrs. Wm. Gray & Co., Limited, to their own order, was taken on her trial trip. This vessel is 300 ft. long by 38 ft. broad by 22 ft. 2 in. deep. She takes the highest class at Lloyd's, and is fitted with all the latest improvements. The engines are of the triple-expansion type, manufactured at the Central Engine Works, and are 1,000 I.H.P. The vessel was run for some hours with the engines going 78 revolutions per minute, when the speed was found to be 11 knots per hour, giving the greatest satisfaction, there being no heating whatever of bearings, and no application of water.

Una.—A hull-built steam trawler for Grimsby, the *Una*, has had her trial trip. Owing to the state of the tide, the vessel could not proceed to Withernsea, but under full steam, off the Spurn Light, a speed of over 10 knots was registered. The vessel is classed 100 A1 at Lloyd's, and has been built by Messrs. Cochrane, Cooper & Schofield, of Beverley. The triple-expansion engines, of 50 N.H.P., with boiler, have been supplied by Messrs. Charles D. Holmes & Co.

Bona.—On March 11th the s.s. *Bona*, a large steel screw steamer, which has been built by Messrs. Raylton, Dixon & Co., Middlesbro', proceeded on her trial trip. This vessel has been built for the English and American Shipping Co., under the management of Messrs. C. T. Bowring & Co., for whom it is the eighth vessel built by Messrs. Dixon. Her dimensions are as follows:—Length, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in., with a deadweight carrying capacity of about 3,600 tons. She is built with raised quarter-deck, and has long bridge extending beyond foremast, thus forming partial awning deck. Her engines, which are by Messrs. T. Richardson & Sons, Hartlepool, of 190 N.H.P., having cylinders 22 in., 35 in., and 59 in. by 39 in., gave every satisfaction. The s s. *Bona* has been built under the superintendence of Captain Towill, inspector for the owners, and Mr. C. Jacobs, consulting engineer. After her trial the vessel proceeded directly on her voyage.

Walker.—On March 11th the steamer *Walker* left Bill Quay on a trial trip. This vessel has been built by Messrs. Wood, Skinner & Co., Bill Quay, for Messrs. Lambert Brothers, London. She is built for the London coal trade, and is specially constructed so as to pass under the bridges on the Thames. The machinery, which has been built by the North-Eastern Marine Engineering Co., Wallsend, is of about 550 I.H.P. During the trial the engines worked exceedingly smoothly and without a stoppage of any kind.

America.—On Wednesday, March 12th, the s.s. *America*, a fine steel screw steamer, which has been built by Messrs. Raylton, Dixon & Co.. Middlesbro', proceeded from the Tees on her trial trip. This vessel has been built for Captain S. M. Kuhnle, of Bergen, Norway, and is intended for the fruit trade between the West Indies and New York, for which she has been specially fitted. Three decks are laid, and the holds are specially insulated, ventilated, and warmed for the purpose of carrying fruit. Her accommodation for captain, officers, and passengers is all on deck, in handsome teak houses amidships. Her chief dimensions are as follows:—Length, 204 ft.; breadth, 28 ft.; depth, moulded, 21 ft. 10 in., with a carrying capacity of about 1,070 tons. Her engines are by Mr. John Dickinson, Sunderland, having cylinders 17½ in., 29 in., and 47 in. by 33 in., which developed on the trial run a speed of 12 knots, giving entire satisfaction. She is commanded by Captain Hooslef, of Bergen.

Ovingdean Grange.—On Thursday, March 13th, the s.s. *Oringdean Grange*, a steel screw steamer which has been built by Messrs. Raylton, Dixon & Co., Middlesbro', proceeded from the Tees on her trial trip. This vessel has been built for Messrs. Houlder Brothers & Co., London, under the inspection of Messrs. Flannery, Baggallay & Johnson, and is of the following dimensions:—Length, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight capacity of about 3,500 tons. She is built on the "partial awning deck" rule, having long bridge extending to forecastle, and fitted throughout as a first-class cargo steamer. Her engines have been fitted by Messrs. T. Richardson & Sons, Hartlepool, with cylinders 23 in., 37 in., 61 in. by 42 in. stroke, and three extra large boilers so as to supply refrigerating machinery, with which she will be fitted for the dead meat trade. The vessel had a most satisfactory run, her machinery developing a speed of 11½ knots.

Castlefield.—On March 13th this steamer, 276 ft. 8 in. by 37 ft. 5 in. by 20 ft. 7 in., built by Messrs. Richardson, Duck & Co., Stockton-on-Tees, for Messrs. F. Bennington & Co., of the same town, left the Tees on her trial trip. Her engines are of the triple-expansion type. They are of 160 H.P., having cylinders 21 in., 35 in., and 57 in. in diameter, by 39 in. stroke, and working at 160 lbs. pressure, and have been built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working satisfactorily.

Bremerhaven.—On March 14th this vessel, which was recently launched by Messrs. Russell & Co. from the Greenock yard, was taken on her trial trip on the Clyde. Her dimensions are:—Length, 340 ft.; beam, 42 ft. 8 in.; depth, moulded, 21 ft. 4 in.; and she has been specially designed for the carriage of petroleum in bulk between America and the Continent. For this purpose the holds are divided into numerous watertight compartments or tanks, each of which has been severely tested by a head of water before launching. She is capable of carrying upwards of 4,000 tons of oil, in addition to bunkers, and is therefore one of the largest, if not the largest, bulk steamer afloat. There are two very large oil pumps, made by the Worthington Co., of New York, each of which is capable of discharging the entire cargo in twenty-four hours, and, as all the piping is duplicated, both pumps can discharge at once if required, two large donkey boilers being fitted to supply them with steam. This is the fourth vessel by the same builders for Messrs. Herman Stursberg & Co., of New York, and, like her predecessors, she has been built to the designs of Messrs. Flannery & Blakiston, of Liverpool and London, who also superintended the construction of the vessel and her machinery. In addition to receiving the highest class at Lloyd's, the Bureau Veritas have registered her with their special mark denoting that she is practically unsinkable. The machinery is by Messrs. Duncan Stewart & Co., of Glasgow, and has cylinders 25 in., 40 in., and 66 in. diameter, with a stroke of 42 in., which will be supplied with steam from two extra large double-ended boilers, having 4,800 square feet of heating surface. Four runs were made on the measured mile at Skelmorlie, when a mean speed at close on 11 knots was obtained, the vessel being brought to her load draft by filling the tanks with water. She will proceed immediately to New York, under the command of Captain Schmidt, late of s.s. *Chailais*.

Trevalgan.—On March 15th the steel screw steamer *Trevalgan* proceeded to sea on her trial trip. She has been built by Messrs. John Readhead & Sons, West Docks, South Shields, and is the nineteenth steamer built by that firm to the order of Messrs. Edward Hain & Sons, of St. Ives, Cornwall. Her principal dimensions are as follows, viz.:—290 ft. by 40 ft. by 21 ft., and she is of the improved well-deck type, having poop, raised quarter-deck, bridge amidships, and topgallant forecastle. She is classed 100 A1 at Lloyd's under special survey; has steam steering gear, direct acting steam windlass, and every appliance for securing efficient and economical working; shifting boards and bulkheads according to Grain Cargoes Act; and is fitted with triple-expansion engines, having cylinders 23 in., 37½ in., and 61½ in. by 39 in. stroke, which are supplied with steam from two large steel boilers, having a working pressure of 160 lbs. Engines and boilers have also been made by Messrs. John Readhead & Sons. On the trial everything worked with the greatest smoothness, the results being completely satisfactory to builders and owners.

Mercury.—On March 15th the *Mercury*, before leaving for the China station, had her commissioned trial, which gave very satisfactory results, a speed of 16¼ knots having been realised with a mean H.P. of 6,000. At her contractor's trial the engines developed 7,290 horses, and an average speed of 18 knots was obtained; but on that occasion she was two feet lighter in the water, special stokers and coal were employed, and the steam blast was used. The *Mercury* carries thirteen 5-inch and four quick-firing guns, so that she is both a swifter and a more powerfully armed vessel than the cruiser *Cordelia*, which she succeeds. Owing to want of time, it was necessary to plug about 200 tubes in her condensers before sailing.

Bendi.—On March 22nd this vessel, built by Messrs. Schlesinger Davis & Co., of Wallsend, for Joseph Hoult, of Liverpool, was tried at sea off the Tyne, and gave very satisfactory results. The steamer is of the following dimensions:—Length over all, 357 ft.; breadth, moulded, 43 ft.; depth, moulded, 24 ft.; and will carry over 5,100 tons when fully laden. She is provided with every necessary appliance for easy and speedy working and manœuvring, and for the speedy and economical working of cargo. The propelling machinery provided by the North-Eastern Marine Engineering Co., of Wallsend and Sunderland, is of the triple-expansion type with cylinders 25 in., 42 in., and 64 in. in diameter, and 45 in. length of stroke. On Saturday everything worked with perfect smoothness, and a speed of 10½ knots per hour was obtained. Shortly after the trial the vessel started on the voyage to the United States. The *Bendi* is the third vessel built by Messrs. Schlesinger, Davis & Co for Mr Hoult, and they have another in hand now nearly ready for launching.

Churruca.—This steamer has just been fitted with new triple-expansion machinery by Messrs. D. Rollo & Sons, of Fulton Engine Works, Liverpool. The vessel's dimensions are:—Length, 190 ft.; beam, 26½ ft.; depth of hold, 16 ft. The new engines have cylinders 18 in., 29 in., and 46 in. diameter respectively, with 30 in. stroke. The engines are on the three-crank arrangement, are fitted with steam reversing and turning gear, and are supplied with steam of 160 lbs. pressure by a large steel boiler having four furnaces. There is also a powerful donkey boiler for supplying steam to the winches, &c. On March 22nd the vessel went out on her official trial, and had a company of gentlemen on board. The owners were represented by Senor Jose R. de Urrutia, one of the partners in the firm of Larrinaga & Co. The trial was entirely satisfactory, the vessel giving a mean speed on the mile of 12¾ knots. The whole of the work was carried out under the superintendence of Mr. James Rode, consulting engineer, Liverpool.

MESSRS. YARROW AND CO., of Poplar, have in the course of construction six shallow draught gunboats for the Portuguese Government, intended for use on the Zambesi. They are similar to those constructed by the above firm in the early part of last year, and in which Major Serpa Pinto made his recent expedition up that river.

Reviews.

The Resistance of Water to a Vessel passing through it; also the best form of Fast Vessel, its Propeller and Engines. By George Albert de Penning.

THIS is a small work criticising our present methods of construction in the Royal Navy, and suggesting certain views and deductions of the writer as to the best form of vessels for the greatest speed, and proposing special forms of vessels. The little work opens with abstract theory upon friction and inertia experienced by solid bodies in passing through water. We see the author's deduction with regard to friction is, that it does not increase much with the increase of extent of surface, and he considers that the inertia of water is a much more serious resistance than mere surface friction. In dealing with the subject of inertia he finds that to lessen the resistance of water we should give our vessels a longer run or incline to the stern than the cut or incline we give the bows; while at the same time by giving a greater length to the body we allow the forward water, when pushed aside by the bows, time to rest, or become inert, or nearly so, so as easier to return to the lesser indraw of water to the stern, from the greater incline, or better run thereto. As the fineness of the lines tend to lessen stability, the author depends upon a very low load of ballast to provide the necessary stability. There would still, however, seem to be some drawbacks in the reduced carrying capacity consequent from extreme fineness of line. In conclusion, we find the ideas put forward in this pamphlet might be well worth attention and careful perusal by those interested in the form and design of vessels; but we fear the ideas embodied by the author are rather crude.

Electrical Trade Directory for 1890. (Printed and published for the proprietors, *The Electrician* Printing and Publishing Co., Limited, by George Tucker, Salisbury Court, Fleet Street.)

WE have before us a copy of the latest edition of this work, and find it to be a very perfect example of its kind. It has been in existence for eight years, and was formerly known as "The Electricians' Directory and Handbook," and has thus been enabled, during its existence, to collect an immense mass of information for the electrical trade in addition to its contents as a mere Directory, and in addition to a British division divided into alphabetical sections of all electricians, and a Trades Directory under various headings of the trade, there is a large Colonial and Foreign division, similarly divided into names and trades, alphabetically arranged. There are added a considerable number of usual illustrated advertisements of all leading manufacturers, &c., in the electrical trade, with a compilation of various matters of interest to electricians, occupying some 230 pages of subject matter, which includes obituary notices of electricians, a digest of the law of electric lighting, specially prepared by A. C. Curtis Hayward, B.A., solicitor, for this Directory; lists of the central lighting stations of the United Kingdom; foreign import duties, and tables of conduction and resistance; wire gauges, and similar useful papers for practical engineers are also not forgotten. All particulars as to telegraph cables are compiled with the greatest care and minuteness, and most of the best known motors and dynamos are tabulated as regards their indicating numbers, power, and candle-power production. Following the directory proper are a series of most interesting biographical sketches of all the best known electrical professors and scientists, accompanied by printed portraits. Altogether, apart from its value as a directory, this volume contains as much subject matter of an interesting character to the electrical trades as it does merely directory matter.

WE have been informed that from the 1st March the shipbuilding business so long carried on at the Dockyard, Dumbarton, by the firm of Messrs. Archd. McMillan & Son will be continued by the company of Archd. McMillan & Son, Limited. The directors of the new company are John McMillan, shipbuilder, Dumbarton; Robert McMillan, of Methlan Park, Dumbarton; James McMillan, ship and insurance broker, London; John Baptie Provost, of Dumbarton, and William Craig, solicitor, of Dumbarton. Mr. Robert McMillan, who for a number of years prior to 1885 was managing partner of the old firm, has been appointed managing director, and will control the policy and direct the management of the new company, which is, we understand, in a position to enter into contracts for the construction of vessels of all kinds on favourable terms.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—ED. M. E.]

BILGE PUMPS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your number for November, 1889, I notice one of the speakers at a meeting of the Institute of Marine Engineers, held at Stratford, read a paper on "Bilge Pumps and their Connections," in which he advocates pipes without rose-boxes. Now, this in my opinion would endanger the pipes getting choked, most likely at some of the valves or bocks leading to the mud-box, and on the bilge side of such valves or bocks, unless he intends that there should be a mud-box for every separate connection. Would it not be better if the straight pipe which I think he very rightly advocates had a large rose-box fastened on its bottom end with a sufficiently large hatch made removable in the flooring, the said box made to lower down into a guide to keep it in position when the ship is rolling? By so arranging, the pipe could be disconnected by a union joint above the flooring, and pipe and box hauled out for cleaning. And why is it necessary to have any bilges under the stoking platforms; why not utilise these spaces for tanks for fresh water for donkey boilers or main boilers, or for ballast tanks according to circumstances, with a central narrow passage to communicate with either end of stoking platforms, that is, of course, if the ship is not otherwise fitted for water ballast throughout, as it is this particular part which gives trouble in heavy weather. My reason for troubling you with this is that while I am glad to see that the subject is being opened up, it is only by ventilating it through such a valuable medium as the MARINE ENGINEER that any change will come about in this important but much neglected question.

I am, Sir,
Yours faithfully,
J. L. (N.Y.H.)

Yokohama, February, 1890.

ERRATA.

We regret that through a printer's error in March number, some of the figures at the foot of the diagrams taken from the engines of the s.s. *Meteor*, and kindly sent to us by Mr. Young, of Leith, got transposed. The mean pressures, I.H. powers, and total I.H. power under *Ahead* should have been under *Astern*, and *vice versa*. We regret this very much, as Mr. Young's diagrams and figures had been most carefully prepared.

THE MERSEY BAR.—The Mersey Docks and Harbour Board have instructed the well-known manufacturers of dredging plant, Messrs. Simons & Co., of Renfrew, on the Clyde, to design and construct powerful sand pumping appliances to be fitted to one of the steam hopper barges constructed by them some time ago for the board. When completed the apparatus will be employed to cut a deep channel through the outer bar of the Mersey. We are pleased to see that this step has been taken, and we hope that the vexed question of the bar will in the near future be settled.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships from February 24th to March 19th, 1890.

2515 A. Campbell. Disengaging gear for ships' boats.
2539 N. B. Dennys. Composition for ships' bottoms.
2540 W. H. Martin. Ventilating stoke-holds.
2576 E. W. Cooper. Lubricating bearings.
2581 J. Smith. Apparatus for obtaining fresh water from sea-water.
2618 H. J. Haddan. Charging furnaces. (S. T. Wellman, U.S.A.)
2641 C. Thomas and M. Cay. Indicating a ship's course.
2683 W. P. Thompson. Steam boilers.

2691 J, W. Brown and W. W Sutcliffe. Steam-engine governor.
2703 J. H. Dales. Steam-engines.
2704 J. P. Cito and P. Funck. Lifting-jack.
2740 W. C. Wood and C. Whitaker. Method of burning smoke in steam furnaces.
2822 R. J. Crowley. Signalling system and apparatus.
2826 G. Wanters. Propellers.
2865 T. Fishburn. Refrigerators.
2872 J. W. Newton. Steam generators.
2887 J. Friedrich and A. Schnarrendorf. Feed-water purifiers.
2893 A. Brown. Triple-expansion steam-engines.
2994 W. P. Thompson. Steam boilers.
3020 Burhans van Steenbergh. Steam boilers.
3029 M. E. Herbert. Steam boiler furnaces.
3031 A. H. Wallis. Compound engines.
3043 A. Bell and A. J. Bell. Steam boiler furnaces.
3048 T. Dale. Smoke-consuming fire-bridge for steam boilers.
3056 J. Murrie. Steam boiler feeding, regulating apparatus.
3063 W. A. Clark. Traps for steam purposes.
3084 B. J. B. Mills. Governors. (T. W. Q. Honeywill and C. J. E. Linnemann, New Zealand.)
3085 B. J. B. Mills. Governors. (T. W. Q. Honeywill and C. J. E. Linnemann, New Zealand.)
3088 H. J. Haddan. Steam generators. (F. J. Haut, Belgium.)
3113 R. Berggren. Couplings for propeller or other shafts.
3116 W. Keyworth. Boiler-tubes.
3118 E. R. Billington. Berths or beds for ships.
3127 J. T. Hedley. Metallic packing for piston and valve rods.
3186 J. Proctor. Steam boiler furnaces.
3196 S. Walker and G. Mills. Valve alarum.
3199 J. Harper. Screw-propellers.
3234 M. Kohn. Direct acting steam-pumps.
3287 A. Anderson. Marine and other steam boilers.
3318 A. Müller. Boiler pumps.
3330 T. Fisher. Screw propellers.
3394 A. F. G. Brown. Metallic packings.
3395 D. J. Morgan. Steam gauges.
3434 L. J Mayer. Fire-extinguishing apparatus in ship-holds.
3485 P. Brotherhood. Slide-valves.
3487 H. H. Lake. Smoke-consuming furnaces. (R. L. Walker, U.S.A.)
3525 W. A. G. Schönheyder. Side-feed lubricators.
3543 T. Elwell. Steam boilers.
3552 W. Auld. Saving fuel and preventing smoke.
3568 J. Mackenzie. Propellers.
3659 E. I. Galloway and J. H. Beckwith. Gear for working slide-valves.
3675 J. Lever, J, Holland, and W. H. Todd. Steam boiler furnaces.
3724 J. W. Brooke. Steam capstans.
3766 J. T. Jameson. Slide valves
3785 C. Smith. Glands for stuffing-boxes. (T. J. Agabeg, India.)
3828 A. J. Boult. Piston packing. (T. D. Child, U.S.A.)

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

EXTRA FIRST CLASS.

March 1st, 1890.	Olsen, Oluf J.	E1C.	S. Shields
„ 15th „	Warden, Robt. C.	E1C	Glasgow

February 22nd, 1890.

Adkins, John H.	1C	London
Allan, Richard L.	2C	N.Shields
Ashton, Frank W.	2C	Cardiff
Banfill, Chas. F.	1C	„
Bayers, James ..	2C	Aberdeen
Carr, Robt. G. ..	1C	London
Caskie, James ..	1C	Cardiff
Clark, Clark C...	2C	Aberdeen
Cowan, Robert..	2C	N.Shields
Crawford, James	1C	Glasgow
Cummins, Mchl.	2C	Cardiff
Cutler, Harry A.	2C	London
Davies, Jos. J...	2C	Cardiff
Doig, Sam. A. ..	2C	Glasgow
Dron, Wm. ..	2C	„
Duncan David ..	2C	„
Florence, James	1C	Glasgow
Fraser, Joseph..	1C	N.Shields
Garrett, Thos. J.	1C	Liverpool
Harris, G. A. ..	1C	„
Harris, H. A. ..	2C	S'hamton
Hepple, Thos. H.	1C	Cardiff
Hughes, Fk. W.	1C	Liverpool
Hunter, John ..	2C	Glasgow
Jack, Wm. ..	2C	„
Johnston, George	1C	Cardiff
McArthur, M. ..	1C	Glasgow
Morgan, Alfred..	2C	Cardiff
Power, Wm. ..	2C	„
Romero, G. .J ..	2C	„
Ross, John ..	2C	Glasgow
Rule, Robt. T. ..	1C	London
Seebie, Alex. ..	2C	Aberdeen
Sharp, Albert E.	1C	N.Shields
Stephens, Wm. H.	1C	Liverpool
Taylor, And. S.	2C	Glasgow
Wedlake, T. H.	1C	Cardiff
White, William	1C	N.Shields
Wilson, James ..	2C	Cardiff
Wilson, Robert..	2C	Liverpool

March 1st, 1890.

Arnison, H. ..	1C	Sunderl'd
Avery, John C.	2C	Liverpool
Blake, James ..	1C	Sunderl'd
Blench, George D.	1C	„
Bone, Robert ..	1C	N.Shields
Brock, Walter J.	2C	Sunderl'd
Clark, Adam ..	1C	Hull
Coulthard, G. R.	1C	Sunderl'd
Dunning, Wm...	2C	Hull
Edwards, W. D.	1C	Liverpool
Ellis, Henry ..	2C	Sunderl'd
Ferguson, Colin	1C	London
Foxlee, John E.	1C	„
Griffiths, E. O.	2C	Liverpool
Hadden, Wm. C.	1C	Hull
Hall, Jeferson M.	1C	N.Shields
Hamilton, G. C.	1C	Sunderl'd
Hedley, Richard	1C	„
Leek, Kennedy..	2C	Liverpool
Mawson, James J.	1C	Sunderl'd
McCall, Robert	1C	„
Metcalf, Arthur	1C	Hull
Newall, James M.	2C	London
Pepper, Alfred..	1C	Sunderl'd
Poole, E. W. ..	2C	„
Proad, John J...	1C	N.Shields
Rackley, Step. A.	1C	Sunderl'd
Ranken, David..	2C	„
Rewcastle, Rbt.	2C	„
Rudden, Sml. L.	1C	Falmouth
Sard, Howard ..	1C	„
Smith, John ..	1C	Sunderl'd
Stoddart, Joshua	1C	„
Swallow, John C.	1C	Liverpool
Thornes, Jas. H.	2C	Sunderl'd
Tippet, Albert ..	2C	„
Vowell, Wm. ..	1C	N.Shields
Whitaker, H. W.	1C	Hull
Wilkin, Wm. A.	2C	N.Shields
Wilkinson, C. W.	1C	„

March 8th, 1890.

Adams, John G.	1C	Liverpool
Alexander, Chas.	2C	Greenock
Anderson, John	2C	Glasgow
Avery, George..	2C	N.Shields
Bailey, James P.	2C	Cardiff
Bardens, Fred...	2C	Liverpool
Bell, Andrew ..	2C	N.Shields
Blackater, T. E.	1C	Greenock
Blair, Alex. ..	2C	„
Bowden, Henry	2C	Liverpool
Brasier, Alfred..	2C	London
Brown, George..	1C	Leith
Byrne, Gerald ..	2C	London
Caird, Alex. ..	2C	„
Campbell, K. ..	2C	Glasgow
Carr, William ..	1C	Leith
Coplin, John A.	2C	Cardiff
Craig, Robert ..	1C	Belfast
Dalrymble, Robt.	2C	Glasgow
Davis, David ..	1C	N.Shields
Elliott, Ed. E...	2C	„
Ellis, Wm. A. ..	1C	Leith
Fairburn, Jas. E.	1C	N.Shields
Foulds, Matthew	1C	Glasgow
Foulds, Robert..	1C	Liverpool
Fotheringham, R.	2C	Greenock
Frank, John ..	1C	London
Gaskill, Wm. B.	1C	Liverpool
George, J. M'N.	1C	N.Shields
Gibson, John S.	2C	Cardiff
Gregory, Jas. B.	1C	Leith
Isles, Peter ..	2C	„
James, Wm. J.	2C	London
Jeffery, Alf. E...	1C	Liverpool
Jones, Humphrey	1C	N.Shields
Laurderdale, Jas	2C	Greenock
Lewis, Richard..	2C	Liverpool
Mather, A. T. M.	2C	„
Mitchell, Alex. W.	1C	Leith
McGilchrist, T. B.	1C	„
NcNaughton, Dan.	2C	Liverpool
McTavish, Neil	2C	Greenock
Newton, W. A...	1C	N.Shields
Phillips, Montge.	1C	Cardiff
Plumbly, Edwin	2C	London
Powell, John ..	2C	Cardiff
Ramsbottom, R.	2C	Liverpool
Reid, Thos. ..	2C	Leith
Renny, Allan ..	2C	„
Richards, Wm.	1C	Glasgow
Robertson, A. L.	2C	Leith
Robinson, Wm.	1C	Liverpool
Ross, George ..	1C	Greenock
Salt, Richd. F...	2C	London
Scott, Joseph ..	2C	Belfast
Scott, Wentw'th	2C	Liverpool
Smith, Daniel ..	2C	Greenock
Smith, William	2C	Liverpool
Smith, William	2C	London
Tatlock, Geo. R.	2C	N.Shields
Turnbull, John E.	2C	Leith
Wilson, Jas. W.	2C	Liverpool
Wylie, Wm. T...	1C	Glasgow

March 15th, 1890.

Black, Wm. C...	1C	Liverpool
Blackford, N. ..	2C	N.Shields
Brown, Jno. ..	2C	Glasgow
Cockburn, A. H.	2C	Liverpool
Couper, James..	2C	Dundee
Duncan, David..	2C	London
Evans, Edwd...	2C	Liverpool
Ingleby, Jno. ..	2C	Hull
Kellie, Robt. M.	2C	Dundee
Lambert, Robt.	2C	N.Shields
Mackay, Charles	2C	Glasgow
McFarlane, H...	2C	„
Methven, Robt.	2C	Dundee
Miller, Wm. T...	2C	London
Mollet, F. W. ..	1C	„
Murdoch, Geo...	1C	N.Shields
Pattison, T. A...	1C	„
Pithie, Jas. S. ..	1C	Glasgow
Robertson, David	1C	„
Rule, Henry ..	1C	London
Sanderson, Geo.	2C	N.Shields
Sims, Jno. ..	2C	London
Spoor, Wm. J...	1C	N.Shields
Stewart, David	2C	Dundee
Sturrock, Hy. P.	2C	„
Vernon, Wm. ..	2C	Glasgow
Williams, Benjn.	2C	London
Wilson, Harry, C.	1C	Hull

The Marine Engineer.

LONDON, MAY 1, 1890.

THE much-lauded system of shipbuilding in water-tight compartments has at last scored a decided success; and though the disaster that befell the Inman Liner *City of Paris* in the Atlantic was of so serious a kind, we consider that, as a complete result, it has been an incident that has reflected the greatest credit upon the Inman Line for the building of the *City of Paris* and many others of their liners. In spite of the flooding of both engine compartments, there was at no time any serious risk of foundering. Our readers all know that after great anxiety, owing to delay, the *City of Paris* was eventually towed by tugs into Queenstown, and she was then found to be in good condition as regards her outer skin, and was still capable, by reason of her duplicate arrangement of engines, boilers, and propellers, to steam to Liverpool, using only one set of engines and propeller. This triumph of the system of twin engines and screws, and water-tight bulkheads has depended much upon the special strength and completeness with which the dividing bulk-heads were constructed. It has already been on many occasions the misfortune of shipowners or passengers to find in the early design of separating bulkheads that their strength was not sufficient to fulfil the purposes for which they were designed, and to carry the water pressure resulting from flooded compartments. Much attention has naturally been given to the causes of the sad accident of the engine of the *City of Paris*, and the confusion resulting from the breakdown are well evidenced in the illustrations we give herewith, taken from photographs of the *débris*. It is still of course a matter of conjecture as to how the accident originated, but the examination of the vessel after she had entered the dry docks of Birkenhead have shown without doubt that a fracture of the propeller shaft was the active cause of the engines running away, and of the consequent breakdown, but as the break occurred in fine weather it is a serious question as to what was the primary cause of the breakage of the propeller shaft. The metal at the fracture appears to be of first-class quality, and it has been suggested that there had occurred a drop of some 6 to 7 inches in the after part of the propeller shaft. It is probable that we have here the primary cause of breakdown, which had been accumulating for a long time unobserved, the breakdown not even being known until the docking of the vessel, since it had taken place inside the casing of the stern tube. The racing of the engines upon the fracture of the shaft appears to have developed the first fracture in the low-pressure cylinder, and in the piston of that cylinder, no doubt the fracture of the cylinder following, and being caused by the jamming of the broken piston inside the low-pressure cylinder, the whole energy of the intermediate and high-pressure cylinders being developed by the crank shaft to cause fracture and destruction of the low-pressure cylinder. It would appear that the low-pressure crank and connecting rod eventually pulled down the whole superstructure of the low-pressure cylinder, since the breaking of its cover would have the effect of removing back pressure from the intermediate and high-pressure cylinders, and thus increase their racing action upon the crank. When the enormous weight of the various parts of the engine are estimated—the low-pressure cylinder weighing 45 tons, the low-pressure piston 10 tons, the piston rod 3 tons, and the connecting rod 7 tons—an idea will be formed of the enormous destruction of such a breakdown in the hold of the vessel; and surprise and gratitude only can be felt that the disaster was not accompanied by serious loss of life, and possibly destruction of the whole vessel, remembering that the engine at the time of the breakdown was running at full speed. As it was, not much harm was done by the actual destruction of the engine, the escape of the men in charge being perfectly marvellous, but the condenser, which is in connection with the sea for the supply of circulating water, having been broken by the falling engine, an enormous rush of water entered the starboard engine-room. As also the falling *débris* knocked several holes through the engine-room bulkhead, the rush of water swamped both engine compartments, and thus brought the gigantic liner to a standstill in the middle of the Atlantic. The engines are triple-expansion, indicating collectively about 18,000 H.P., the triple cylinders are 45 in., 74 in., and 113 in. in diameter respectively, by 5 ft. stroke, the boiler pressure is 150 lbs., and the engines make about 85 revolutions per minute. The *City of Paris* is a sister ship to the *City of New York*, and is 565 ft. in length, 63¼ ft. beam, and of 10,500 nominal gross tonnage. She was built by Messrs. J. & G. Thomson, on the Clyde, and she still remains about the fastest steamship afloat. It is extremely difficult from the utter chaotic remains of the accident to be able to form a definite opinion as to what broke first, or for what exact reason the first breakage occurred, but there seems no reasonable doubt that the breakage of the propeller shaft caused "racing," and the racing caused a breakdown of the low-pressure cylinder, the rest would follow naturally. It may be noticed that possibly the disaster might have been prevented by more perfect governor control. It appears that the builders had already intended applying such governors and attachments for controlling the low-pressure cylinder according to Messrs. Durham, Churchill & Co.'s patents, but unfortunately from some cause or other they had not been fitted. As it was, they had relied upon sufficient time being given to the engineers in charge so that they might cut off the supply of steam to the engines to prevent "racing." It is evident in this instance that the destruction was too sudden and unexpected for the engineers to have time to avert the disaster.

The breakdown of the *City of Paris* is a most serious calamity to the owners; yet to many others—marine engineers and shipbuilders—it has proved an incident of the greatest importance and usefulness, and the experience gained will, doubtless, be used to its full extent in the design and working of all marine engines in the future. This breakdown may be looked on in the light of a huge experiment—an expensive one we will admit—but one which will eventually be the means of the saving of many lives and much valuable property—as it has shown the weak points of what were supposed to be among the finest marine engines in existence. The accident to the *City of Paris* is one of frequent occurrence to screw steamers; in a lesser degree in the majority of cases it is true; but what would be the effect were it as bad? Few steamers have the number of bulkheads or the strength of the *City of Paris*, and an accident much less in extent of the damage done to her would be quite sufficient to send them to the bottom with all on board. Does not this throw some light on the otherwise unaccountable cases of steamers "missing"? We are glad to see that the primary question has been at once recognised by those interested. In our contemporary journals, and even in the House of Lords, the question has been asked, "Why was not an efficient governor fitted"? Everyone understands that, almost without exception, every land engine, however small, is fitted with a governor to keep them at an uniform speed when the [illegible]y have to do is varied—intentionally, or by reason of the breakage of any of the connections—and why should not a similar appliance be fixed to every marine engine, which is always in danger of being relieved of the whole, or part of its load. In rough weather the propeller is continually coming up out of the water, and even if the weather is fine the shaft may break, the screw or some of its blades may be lost, or a dozen things may happen, entirely unforeseen, and before anyone has time to act, the engine races away at an enormous speed, and immense damage is done to the engine and hull; sometimes sufficient to cause the loss of the ship. If an efficient governor were fitted the engines could not practically exceed their normal speed, even if the *whole* of their load were removed. To really efficiently control triple engines the governor must have command over more than the H.P. throttle valve; as the steam already in the casings, in conjunction with the vacuum, acting on the Int. and L.P. pistons is quite sufficient to cause a serious increase in speed even when the throttle is dead shut. It appears from a letter in our contemporary, *Engineering*, of the 18th April, that Messrs. Thomson actually bought from Messrs. Durham, Churchill & Co. four governors and four of their "Compound Attachments" for controlling the low-pressure cylinders for the *City of Paris* and *City of New York*, but they were never fitted, and a governor acting from the stern put in instead, which would never come into action except in a rough sea. Had the governors been fitted as originally intended, there is no doubt but that in the steamship under notice the damage would have been confined solely to the broken screw-shaft. One point that the *City of Paris* mishap definitely settles is that triple engines *do race*. We have always held that they would run just as fast or faster than any other engine if the load were removed; but many engineers have asserted as a fact that they do not, "because they are so well balanced." This is no explanation; and we think they would have been troubled to prove their assertion. Now the *City of Paris* has most practically settled the point for them. Our valued contemporary, *Engineering*, in an interesting article on this smash, says that even so large a factor of safety as 9 in some parts of the engine would have entirely disappeared by the time a three-fold speed was reached. We recommend this point to those owners who have been assured by builders "that their engines are strong enough to stand any amount of racing." Either they are *not*, or the ships have to carry tons of useless dead-weight, which would have been much more profitable as cargo. We think there is no doubt but that engineers will see the absolute necessity of having a governor which shall control the engines whenever they are running, in smooth water the same as in rough; probably also the Board of Trade will take the matter up, and make a properly fitted governor one of the necessary items in a steamship's equipment.

THE accident to H.M.S. *Barracouta* occurring as it did on her trial trip, and causing loss of life, has raised much interest in the public mind, and particularly amongst engineers, as to so unwonted an occurrence, when everything was new and strong. Nor has the result of the inquest been received with much satisfaction by experts, as to any good proof or elucidation of the conditions tending to produce so unusual and disastrous an accident. We must, however, remember that a coroner's inquest is not a committee of enquiry into scientific points as to causes, but merely as to the actual facts directly causing death. There is little doubt as to the fact that flames were forced from the furnace doors into the stokehold, or that the crown of the boiler collapsed, but there is still much divergence of opinion as to causes producing such results. It is usual to suppose when a furnace crown collapses, that there has been shortness of water, but so far as direct evidence goes, there seems not to have been less than 3½ in. on the crown of the combustion chamber. To meet this difficulty, it has been suggested by Mr. Parker, one of the technical assessors, that owing to intense evaporation, the water on the crown might be in such a state of violent bubbling or ebullition that the water could not obtain sufficient access to the plate, and thus allowed over-heating to take place. It must, however, be remembered that in a locomotive fire-box the depth of water on inclines on the top of the fire-box is reduced to 3 in., which is always there considered sufficient, and does not lead to accident, although the combustion of fuel per grate area is larger in a locomotive than in any forced draught marine boiler. As to the theory set up by Mr. Manuel, the other assessor, that the violent leakage in the combustion chamber might have caused the beating back of the flames into the stokehold, there does not seem to be direct evidence that there was any large amount of leakage when running, although it was found to leak freely in an after test. It is, however, not an unknown event in tubular boilers for the draught to receive a check, and for a back draught to be caused out of the furnace doors, and this tendency would be increased by damp and moisture in the tubes chilling the hot air. It would appear as a conclusion that forced draught by induction instead of direct pressure is the safer of the two as regards this danger. Where, however, there are deep green fires, which appear to have been the case with the *Barracouta*, and much carbonic oxide accumulating above the fires, it is probable that the sudden admission of air above the furnace by opening the door might set up an instantaneous ignition of the carbonic oxide to form carbonic acid, which, by its sudden formation in bulk, would almost have the effect of an explosion in the furnace and flues, the ready escape to the chimney being much hindered by the tube plate of a multitubular boiler.

ON THE APPLICATION OF A SYSTEM OF COMBINED STEAM AND HYDRAULIC MACHINERY TO THE LOADING, DISCHARGING AND STEERING OF STEAMSHIPS.[*]

By A. BETTS BROWN, F.R.S.E., MEMBER.

SINCE addressing this Institution in 1884 on the subject of a complete system of direct-acting hydraulic machinery for first-class passenger steamers, the author has effected many improvements, which have been suggested by the varied types of over fifty steamships fitted.

The hydraulic system is indispensable in ships of great beam, with their hatches placed too close to the mast to admit of the derrick swinging clear of the ship's side; this being the outcome of giving the passenger accommodation in the design of the ship the first consideration. The facility with which a hydraulic derrick can be placed on the mast, embodying within itself lifting, topping, and slewing machinery, all controlled from the deck, yet without encumbering it, places the hydraulic system in the front of any other.

The hands of the naval architect are set free in the design of a ship, and he is clear of that difficult problem, viz., having to provide space for deck-engines, length and outreach of derricks, and relative position of hatches, all of which involve special appliances to meet the views of the stevedores, who have to work out cargo in the shortest possible time, and whose sympathies are only with those who make their particular interest the paramount one in the general compromise which obtains on board ship.

When at sea, captains and other officers are equally anxious to have their departments absolutely perfect, and the author will endeavour to give in this paper an account of the outcome of the various complaints made by these difficult-to-please gentlemen, by which term no offence is meant, but rather a compliment, as without such fault-finding, duly boiled down, he would not have made the advances to be described.

THE HYDRAULIC DERRICK.

The derrick is shown in vertical elevation fig. 1, and in plan fig. 2, similar letters indicating similar parts in both figures.

A is the lifting cylinder, with its ram and pulleys placed between the girders of the derrick. On the right-hand side is placed the slewing cylinder B, with its ram, pulleys, and rope tackle made fast at C, the derrick being pulled in and falling out by gravity, due to the rake of the mast.

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[*] Read at the thirty-first session of the Institution of Naval Architects The Earl of Ravensworth, President, in the chair.

On the left-hand side is the topping cylinder D, which, with its ram pulleys and tackle in duplicate, lowers the derrick over the side of the ship, the hatch being too close to the mast to admit of cargo being delivered over the side without such appliance.

Water is admitted to these cylinders through stuffing-boxes at E, being controlled by the three valves and levers, situated close to the hatch at F. All the motions are independent, and can be worked simultaneously. The derrick is stowed horizontally when at sea, and by the swivel pulley at the point of the jib, its lifting cylinder suffices to raise and lower the derrick.

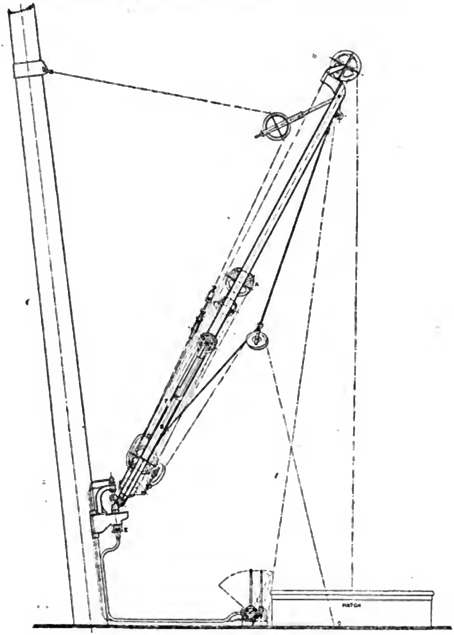


FIG 1.

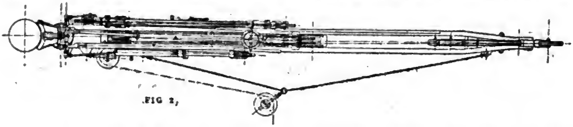


FIG 2.

We come now to the latest development of such appliances, designed to meet the shipowner's view of moderate cost.

In cheap cargo ships, and those carrying few passengers, the large percentage of cost which the hydraulic system bears to the total cost of the ship is principally brought about by the expense of the compound surface condensing pumping engines with steam accumulator. Indeed, the bulk of the difference of cost of the two systems (steam winches or hydraulic gear) is in these engines.

The advent of high-pressure steam, however, has enabled the author to preserve the general deck discharging gear identical, so far as speed of working, noiselessness, and durability are concerned, but to use steam as the motive force in place of water, and so dispense with the pumping engines, as well as the space occupied in the engine-room.

Although this derrick does not attempt to compete with hydraulic machinery, yet its action is precisely similar, and the modern high-pressure steam (150 lbs. to 180 lbs.) enables the work of lifting to be done by a comparatively small diameter steam cylinder. In fact, the derrick is lighter than a hydraulic derrick, having slewing and topping gear, which motions, however, cannot be conveniently fitted to the steam derrick. It is therefore advisable to hang these derricks with the points of support plumb, and they will then swing quite easily by hand with the usual tackles.

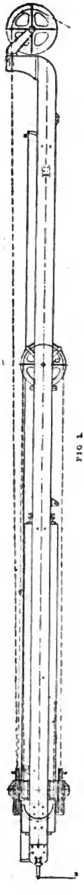


FIG 1.

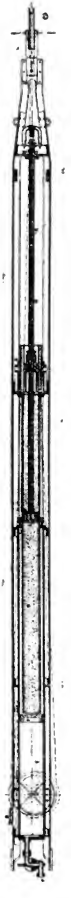


FIG 2.

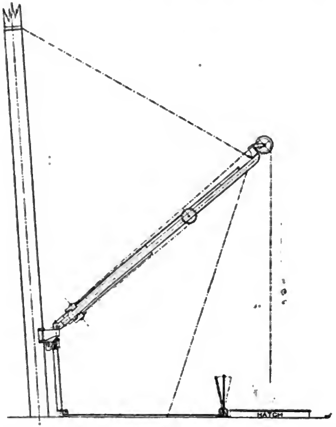


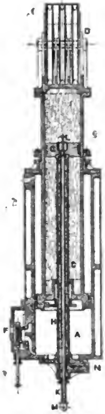
FIG. 3.

STEAM DERRICK.

The accompanying drawing, Fig. 1, shows a side view, and Fig. 4 in section, while Fig. 3 shows the derrick in position, with valve handles close to the hatch.

A steam cylinder A is fitted between two channel beams (which form the derrick), in which works a piston B, having a trunk or ram C, carrying at its extremity a cross-head D, and two grooved lifting pulleys fitted with wire rope, which passes round other fixed pulleys E E. When steam is admitted under piston B, through the pipe F, the load is raised. It is necessary, however, to control the movement of this piston, that an inelastic fluid should be interposed in the operation of heaving and lowering, otherwise the piston and its ram might move like a shot out of a steam gun. To effect this, the trunk C is bored out and fitted at its upper end with a stationary piston G, which is carried by a tube H, fixed to a cross-head at the point of the jib; the trunk being provided with a stuffing-box at its upper end. A rod K passes through a stuffing-box in this tube for the purpose of opening a clack-valve L in the stationary hydraulic piston, which valve is only allowed sufficient lift for the maximum lifting speed of the derrick, which may be 5 ft. to 10 ft. per second. The whole of the interior of this trunk is filled with water, shown in dotted lines. In making a lift it will be seen that all the water has to pass to the upper portion of the stationary control piston, and, as the valve falls into its seat, and the steam is exhausted, the load will be held until this valve is opened by pulling the rod M on end, lifting the valve L out of its seat, when the load will descend in exactly the same way as is done in hydraulic derricks. The rod is actuated by a separate lowering lever, shown in Fig. 3. The trunk is kept filled with condensed water under boiler pressure by being connected to a reservoir having a sufficient quantity of condensed water by the branch N, so that it will always remain full, and will compensate for the displacement of the tube H. The annular space is connected with the exhaust steam pipes by trunnions, not shown. The lifting rope may be varied in length by being attached to various points on the side of the derrick, either direct or by passing round the segment S, so as to economise steam when lifting through short heights.

It is claimed for this derrick that it is simple, rapid, and noiseless, and being hung entirely on the mast, it occupies no deck space, and is suitable for the cheaper class of cargo and passenger ships, where first cost is a desideratum.



SECTION OF CRANE LIFTING CYLINDER.

FIG 4.

The following comparative tests for consumption of steam have been made with the ordinary ship's steam winch and combined steam and hydraulic derrick, both working at the end of a line of steam pipes 200 ft. long, having exhaust carried back to surface condenser, and raising one ton through 27 ft. twice in one minute:—

Steam Winch, 6 in. Cylinders by 11 in. Stroke.

1st Trial of 30 Lifts	..	Condensed Water,	329 lbs.
2nd ,, ,,	..	,, ,,	315 ,,
3rd ,, ,,	..	,, ,,	337 ,,
		Total ..	981 lbs.

Steam Derrick.

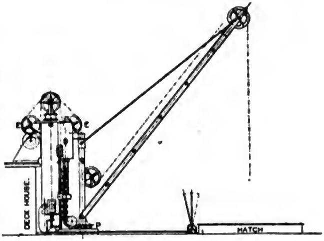
1st Trial of 30 Lifts	..	Condensed Water,	263 lbs.
2nd ,, ,,	..	,, ,,	250 ,,
3rd ,, ,,	..	,, ,,	219 ,,
		Total ..	782 lbs.

Mean Consumption per Lift—Winch .. 10·9 lbs.
,, ,, Derrick .. 8·13 ,,

Where masts are not available, a convenient form of crane is shown in Figs. 4 and 5, and to an enlarged scale as here shown. This is supported by being bolted to the deck at the lower part of the lifting cylinder, the upper part being attached to the deck-house. Fig. 4 (1st section) shows the lifting cylinder with hydraulic controlling ram in section, similar letters of reference referring to similar parts as already described in the derrick, the only difference being that the tube H, carrying the stationary piston, passes down through the cylinder end in place of up, as in the derrick. To slew the crane in and out board, a double-acting steam cylinder O operates on an endless chain by its piston and double rods, the chain passing round a pitched wheel P, keyed on the crane post Q, from which the jib is suspended.

The swinging valve is controlled by an automatic cut-off gear R, so that the jib will stop at any point assigned to it by the travel of the swing handle in its quadrant.

Where a deck-house is not available, this crane can be arranged on the usual post passing to the lower deck, in which case an all-round swing can be obtained. The length of the lifting rope may be varied according to the height of lift required by the winding drum S, carrying the fast end of the rope, so that the steam piston may be kept as far as possible working at the lower end of the cylinder, otherwise steam would be unnecessarily wasted.



COMBINED STEAM & HYDRAULIC DECK CRANE.

FIG. 5.

The next important subject is the question of steering gear, which, from the various reports of captains, appears to formulate itself into the following requirements of an ideally successful steering gear, whether it be actuated by water or steam:—

(1) The steering engine or machine should be attached to the rudder head, without the intervention of chains or ropes.

(2) It should let go the rudder when unduly strained, and, when the abnormal strain has gone, must return to its former position.

(3) An easy method should be provided of connecting from steam to hand gear, which shall not involve the engagement of a clutch, or the more common practice of shipping large bolts into a fixed cross-head from a loose one, all of which appliances take much valuable time to get into their places, particularly when a ship is rolling at sea, with the rudder adrift.

(4) The communication to the bridge from the machinery aft should be of a kind which dispenses with rods, chains, and shafting, all being equally troublesome to the shipbuilder to arrange, and to the officers attending to them to keep in order, involving oiling bearings, pulleys, and tightening up ropes and chains.

To meet this want, the author has designed what is termed a steam tiller and telemotor.

Steam Tiller and Telemotor.

Fig. 1 shows an elevation of the steam tiller with the hand steering gear, Fig. 2 being the plan. Fig. 3 shows the telemotor in vertical section. Fig. 4 is the same in plan, Fig. 5 being the corresponding cylinder aft, and also shown in section.

In Fig 1, A is a cast-steel tiller keyed on to the rudder head B, having at its after end a double jaw C fitted with bearings. At the other end D there is a toothed segment, into which a pinion works.

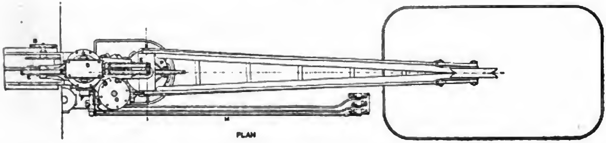
Aft of the tiller there is bolted to the deck a toothed quadrant E, into which the steel pinion F gears. The shaft G is shrunk into this, and, passing through the bearings on the jaws of the tiller, terminates in an expanding clutch wheel H.

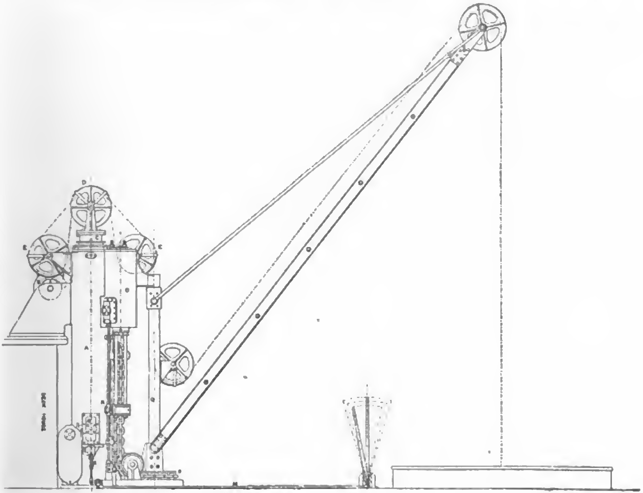
The worm-wheel I embraces this clutch wheel, there being a strip of elm wood interposed circumferentially between the two. This wood possesses the property of having a co-efficient of friction nearly constant, whether it is wet or dry. The necessary friction to drive the shaft G is effected by the worm and worm-wheel arrangement J expanding the clutch wheel against the laminated spring K.

The steering engines are carried on the tiller, and move round with it, receiving and exhausting their steam through a double stuffing-box arrangement L mounted on the axis of the rudder head. The steam cylinders M are of the usual well-known construction, originally introduced by Mr. McFarlane Gray, fitted with piston valves, the reversal being effected by changing the direction of the steam entering the cylinders through the slide valve N.

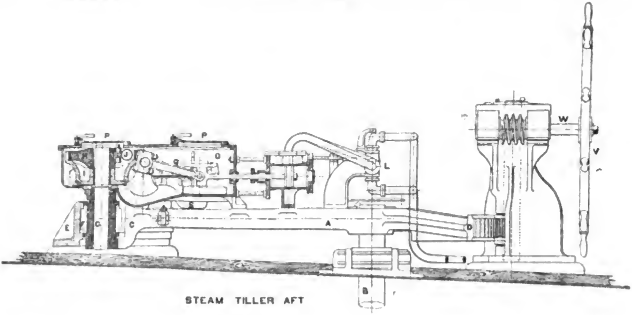
The whole of the valve gear, viz., slipper guides, connecting rods, crank shaft, and eccentric rods are enclosed in a water-tight box or chest O, having two hinged lids P for occasional examination.

For the purpose of oiling the various parts, a tank Q is fitted between the engines, from which proceed pipes leading to every bearing and joint, piston rods, valve rods, worm and worm-wheel. Two valveless oil pumps R R are worked from the eccentric rods, and they keep up a continual supply of oil, which returns into the well S, the large end of the connecting rods dipping into a trough, as well as throwing the oil generally about the clutch and worm-wheels, and a regulated quantity finding its way down the shaft G to the main bearings on the end of the tiller.


PLAN



ELEVATION



STEAM TILLER AFT

FIG. 1.

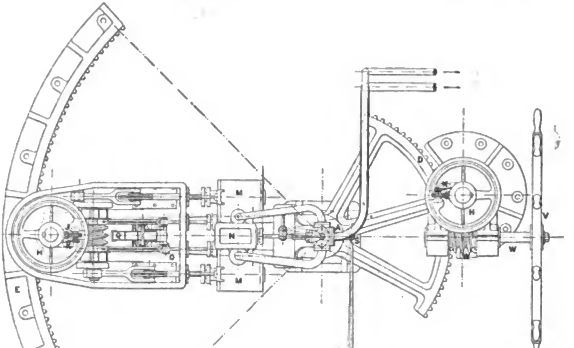


FIG. 2.

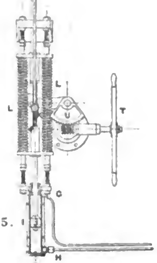


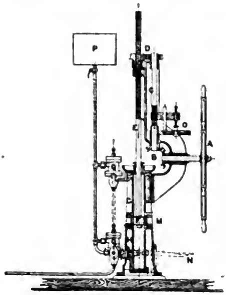
FIG. 5.

From this arrangement it will be seen that it is only necessary to pour a few gallons of oil into the machinery casing, and the oiling of the various parts will be effected automatically by the working of the steering gear, an important point with deck machinery, which, as a rule, is sadly neglected. It may be mentioned that there is only one shaft other than the crank shaft, and only one key in the gear, the crank shaft pins, eccentrics, cranks and worm being all in one piece of cast steel.

The steering lever operating on the valve is shown at S, and is actuated by a hand wheel T with worm and worm sector U with its shaft and corresponding lever. This opens the slide valve N in either direction, and the motion of the tiller and engines moving round shuts it again.

The hand steering wheel is shown at V, which is mounted on a worm shaft W, which gears into a worm-wheel precisely similar to that of the steering engine at I. A vertical shaft passes down in a steel pinion, which gears with the toothed segment D. This shaft is brought into gear with the worm-wheel by a similar expanding clutch as that on the engine shaft, and lettered similarly H.

In proportioning the strain of the engine with the torsional strain on the rudder head it is not necessary to consider the question of a safe strain; in fact, the engines may be made over-powerful, so as to allow for reduced boiler pressure. In practice the clutch H is expanded at full speed trials sufficiently tight to put the helm hard over, but no more, and the worm-wheel screw then set to that, so that in changing from hand to steam it cannot be set up dangerously tight. It will be seen from this arrangement that any abnormal strain on any part of the gear or rudder head, caused by heavy seas, must be transmitted through the elm wood liner, held tight by the spring K, which has not sufficient hold to break any part of the machinery, but slips, and the valve gear opening brings the rudder into its original position. This friction clutch arrangement being also on the hand steering gear, admits of connection at any position of the rudder, even when flying about adrift, and the change from steam to hand, or *vice versâ*, is effected without shipping bolts or jaw clutches, so difficult to manipulate in emergency.



TELEMOTOR ON BRIDGE

FIG. 3.

It is therefore submitted that this gear fulfils the foregoing conditions, 1, 2, and 3.

Telemotor.

The object of this device is to communicate the motion of a revolving wheel at the bridge to the rectilinear motion of a piston and its connecting rod attached to the steering lever, acting upon a steering valve, which may be either steam or hydraulic.

Fig. 3 shows a vertical section of what is really a hand pump. The steering wheel A drives a shaft and pair of bevel wheels B, which actuate a vertical shaft C, so arranged that it can be carried up to the bridge, the pinions D, one of which forms a nut acting on the screwed piston-rod E. This is shown at mid-gear; the piston F being in a cylindrical distance piece forming part of the upper cylinder G and the lower cylinder H, this distance piece, however, allows a free passage of water through an annular port from the cylinder G to the cylinder H, being open at the top and bottom of these cylinders one-sixteenth of an inch. On turning the wheel A the piston F will travel one-sixteenth of an inch each way before the cylinders G or H become effective hand pumps.

Referring now to Fig. 5, which is situated aft close to the steering gear, this consists of an ordinary double-acting hydraulic cylinder I fitted to the piston J and its rod, which is connected to a cross-head K, and from there to the lever S in the steering gear. The after steering wheel T being disengaged two spiral springs L L are so arranged that they tend to force the piston J into mid-stroke, and consequently bring the rudder amidships, having not only sufficient power to overcome the friction of the gear aft, but tend to make the wheel amidships run back to mid-stroke.

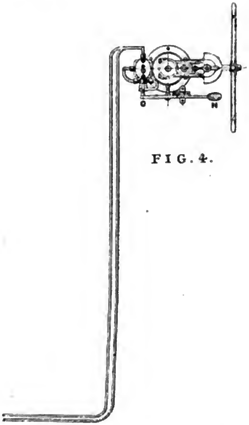


FIG. 4.

The cylinder G on the bridge is connected by a pipe, ½ inch in diameter, to the corresponding letter G on the cylinder aft, while the cylinder H is connected to the corresponding letter H aft. It will be seen that (the pipes and cylinders being full of water) the piston F passes the distance piece, say on the upper stroke, the piston J aft will move towards the cylinder end, thus increasing the initial compression of the springs L L. Let us assume that we put the helm hard over in that direction, and leave it there for an hour, and we find that a slight leakage in the piston has allowed the gear aft, by virtue of the springs, to come amidships, while the bridge wheel indicates hard over; the order is now given to reverse the helm, that is, to cause the piston F to leave the cylinder G and to enter the cylinder H.

The gear being out of correspondence, it sends the water into that half of the cylinder aft lettered H, driving the piston J hard over towards the stuffing-box end of the cylinder; but whenever the piston F enters the distance piece, there is established a free communication between the cylinders on the bridge and both ends of the cylinder I. The springs then exert their force and run the gear amidships, and the whole is again in correspondence.

An extreme case has been taken of an hour's time hard over with a leaky piston; but as in practice the helm is put very frequently to port or starboard, and the combination of the piston F passing through the cylindrical distance piece M with the springs aft, tending to put the steering-gear amidships, causes a continual rectification of the relative positions of the bridge wheel and the cylinder aft, which may be disturbed by a worn-out leather.

Under exceptional circumstances it may happen that when carrying weather helm for a long period of time, the piston F may be working entirely in the cylinder G or the cylinder H, and having no opportunity of passing the distance piece M, and consequently with a defective piston there would be no automatic regulation. For that purpose a foot lever N is provided, which opens a cock O, and thus enables the steersman to run his wheel back and bring the indicator over to zero, when the steering is then effected with the piston working in or about the distance piece, and the automatic regulation will go on.

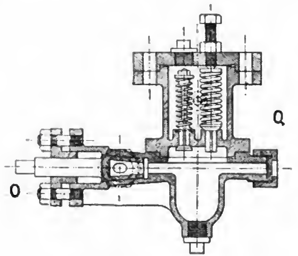


FIG. 6.

STEAM TILLER WITH TELEMOTOR.

Any external leakage is made up by water stored in a small tank P, which enters the end of the cylinders by inlet valves in the boxes Q Q, in which are also placed safety valves to allow for the expansion of the water in the pipes through change of temperature.

One of these boxes is shown in section to a large scale at Fig. 6. It is scarcely necessary to say that with well-fitted and good leathers no regulation takes place, but it is necessary to provide some such device, the tendency of which is to go *into order* rather than, as is usual, *out of order* as wear takes place.

INSTITUTE OF MARINE ENGINEERS.

THE annual general meeting of the Institute of Marine Engineers was held in the Langthorne Rooms, Broadway, Stratford, on Saturday, March 29th, when, in the absence of Mr. A. Beldam, President, the meeting was presided over by Mr. J. McF. Gray, vice-president. After a brief address by Mr. Gray the business of the evening was entered upon by Mr. R. Adam moving, and Mr. C. L. E. Melsom seconding, the appointment of Messrs. J. W. Richardson and C. Noble as scrutineers of the voting papers regarding the election of the council and office bearers for the ensuing year; this resolution on being put to the meeting was carried unanimously. The honorary secretary was then called upon to read his report and balance-sheet. He reviewed the history of the Institute during the first year of its existence, and briefly referred to the initial work of the organising committee. Touching references were made to the loss by death of several members, especially to those who were engaged on board the steamers *Duke of Buccleuch*, *Glencoe*, *Erin*, and *Quetta*, when these vessels were lost.

The annual balance-sheet showed an eminently satisfactory condition of the finances, the receipts being £499 10s., the expenditure £302 18s. 8d., showing a balance of £196 11s. 4d.

The lists of books, magazines and other property belonging to the Institute were submitted along with the report. Also a balance-sheet in connection with the Malcolm Campbell Memorial, and a list of books attached to the memorial in the shape of a loan collection.

The honorary secretary embodied in his report a recommendation of the council to the effect that,—

"The addition of Honorary Vice-Presidents to the existing orders of membership should be made. The object is to admit of the election of well-known gentlemen of position who are interested in marine engineering, and whose sympathies are in the direction of the progress and advancement of marine engineers in everything that tends to greater efficiency and economy in the working of steamships.

"It is proposed to invite the special attention of several prominent steamship owners to the claims and growing influence of the Institute, with a view to securing their co-operation and help towards erecting or purchasing a building which may be fitted with class and lecture-rooms, and other arrangements calculated to give our young engineers opportunities of improving their minds, and better fitting them for their increasing responsibilities."

Mr. Thos. Wiltshire moved, and Mr. H. Ives seconded, the adoption of the report and balance-sheet, including an endorsement of the recommendation of the retiring council. The scrutineers were then called upon to declare the result of the voting papers, which was given as follows:—President, Mr. G. W. Manuel; secretary, Mr. Jas. Adamson; treasurer, Mr. R. Leslie; Members of council, Messrs. L. P. Conbró, D. Greer, A. Gibb, J. G. Hawthorn, D. McMillan, A. J. Maginnis, M. Prior, F. W. Shorey, J. Stewart, with the addition of Messrs. R. Adam, R. Bruce, C. Hudson and S. C. Sage, new members; Mr. J. R. Ruthven as minute secretary.

Mr. J. A. Rowe moved, and Mr. S. C. Sage seconded a vote of thanks to the retiring president, Mr. A. Beldam, and the vice-presidents, with special reference to the great interest and warm support which had been accorded to the Institute by Mr. J. McF. Gray, who, in addition to the close attendance he has given at the various discussions, had manifested his great interest by his presence at the annual meeting, and presiding in place of Mr. Beldam, whose unavoidable absence was much regretted. The vote of thanks was very warmly accorded and briefly responded to by Mr. Gray.

To the office bearers and council a vote of thanks was moved by Mr. J. D. Churchill, and seconded by Mr. W. W. Wilson, with special reference to the hearty way in which the great work in connection with the organising and building up of the Institute had been conducted. Special reference was made to Mr. J. H. Thomson, who had acted as deputy chairman, and to the honorary secretary, upon whom had devolved most, if not all, the planning and seeing the designs carried into effect. Considering the indebtedness of the Institute to the honorary secretary as mainspring of the Institute, a motion was submitted to the effect that he be elected a life member in appreciation of the valuable services he had rendered to the Institute. The motion, on being put to the meeting, was unanimously carried. Mr. J. H. Thomson duly responded to the vote of thanks, endorsing the views expressed by the mover and the seconder of the motion regarding the work of the honorary secretary, to whom he left the further reply to the enthusiastic way in which the vote of thanks had been accorded. The honorary secretary then expressed his thanks for the high honour conferred upon him, and the warm manner in which he had been referred to. His efforts had been placed in the direction of carrying out a motto which, in his estimation, was a good one, and one he had adopted many years ago, and had endeavoured to follow. "Man's success in life is measured by the good he does."

The work aimed to be accomplished by the promoters of the Institute was good, it was good for the individual and good for the community. By being helpful to young engineers in training them to think aright, and to improve themselves by better fitting all who come within its influence, the Institute would be a means of good to the whole nation.

Mr. McF. Gray gave an earnest and interesting address on "The future objects and aims of the Institute," and read extracts from a paper he had prepared and read some years previous, and which bore upon the thoughts he had given expression to. He impressed upon the meeting that in order to retain our national supremacy in the Merchant Navy, very great efforts would require to be made, as other nations were doing their utmost to train up their young engineers at considerable cost with a view to bringing them forward well equipped for taking positions requiring technical and scientific knowledge, coupled with practical experience.

An adjournment was then made for coffee, after which Mr. G. W. Manuel, the new president, entered upon his duties and gave his opening address, in which he said he looked back with no small surprise on the amount of work which had been accomplished during the past year. The amount of vitality which was evidently in the members he looked upon as very great, and, therefore, it augured well for the second year upon which the Institute had entered, and it would give him great pleasure to occupy the position to which he had been elected by the vote of the membership. He pressed home upon all the necessity of thinking out the various questions connected with marine engines and boilers, and the various machines now fitted in the new steamers; electric for lighting; refrigeration, &c. The Institute would become a power in the land for bringing forward the claims of marine engineers to a higher training being insisted upon before they are allowed to enter upon duties in the engine-rooms of steamers, even in junior capacities. He pointed out that the duties of engineers would now rest more and more upon watching closely in the direction of increasing the efficiency of the machinery placed in their care and giving double attention to the most economical way of conducting the whole work of the machinery department of steamships, not only the main engines and boilers, but the auxiliary engines and machines.

Mr. Manuel closed by giving the following data showing the progress made during fifty years in the steamers of the Peninsular and Oriental Steam Navigation Co.:—

Year.		Ship's Name.	Gross Tonnage.	I.H.P.	Speed in Knots.	Coal Consumption. Tons per day.	lbs. of steam pressure per sq. in.	Description of Engines.
	1837	"Iberia"	516	180	8	40	7	Paddle
Years later.								
15	1852	"Indus"	1950	1367	10 to 11	—	12	Paddle Oscillating
15	1867	"Hindostan"	3113	3194	12	—	30	Screw Horiz.
15	1882	"Ballarat"	4752	4500	13	—	90	Comp. Inver.
5	1887	"Oceana"	6600	7000	15·7	83	150	Triple-expansion

Comparison of the P. and O. fleet of steamers from the year 1837 to 1887, showing the progress made in fifty years, and which is chiefly due to the improvements in the machinery along with form of vessel better adapted for easy propulsion.

Comparison between "Iberia" and "Oceana," that is, ships built in 1837 and 1887 = 50 years.

Year.		Ship's Name.	Gross Tonnage.	I.H.P.	Speed in Knots.	Coal Consumption. Tons per day.	lbs. of steam pressure per sq. in.	Description of Engines.
50 years	1837	"Iberia"	516	180	8	40	7	Paddle
	1887	"Oceana"	6600	7000	15·7	83	150	Triple
These figures show an increase in number of times, viz.:—			times 13 nearly	times 40	nearly 2	only 2	over 20	

You will see from the figures the speed and size of vessels has been gradually increasing, and that the last move has been a very considerable one, and it will be a question more for the shipowner than for the engineer as to how far the increase shall be carried. In the year 1837 steamers were built about five times as long as they were broad, this proportion of length to beam gradually increased to 10 to 1 in 1874, after which the ratio slowly decreased to between 8 and 9 to 1 the present proportion.

Mr. R. Bruce then moved, and Mr. W. White seconded, a motion appointing Messrs. J. A. Rowe and G. W. Kidd as auditors for the ensuing year; this was carried unanimously.

Messrs. H. E. Lester and R. Leslie then addressed the meeting on the subject of erecting a building for the Institute to enable the plans which had been laid down by the council being carried into effect. Class and recreation-rooms, lecture hall and rooms in which young engineers, strangers in port, could find accommodation at reasonable rates. It was stated that a sum of not less than £10,000 would be required. Mr. Lester offered to start the building fund by a donation of £10, and £10 more for the purpose of convening a meeting at which the claims of the Institute could be laid before an influential audience with a view to raise funds for a building to embrace all the objects aimed at. Messrs. L. P. Conbró and J. D. Churchill each offered £10, Alderman G. W. Kidd £10 10s., and Mr. H. W. White £5.

The president, Mr. Manuel, considered that the offer of Mr. Lester, added to his suggestion, was a good one, and he would be pleased to add £20 to the donations already promised.

The meeting, which was of a highly interesting character, was brought to a close by a vote of thanks being accorded to the president.

A Meeting of the Institute of Marine Engineers was held in the Langthorne Rooms, Stratford, on the evening of Tuesday, 1st April, when the adjourned discussion on "Friction on Screw Propelling Engines" was resumed. The meeting was presided over by Mr. L. P. Conbró. The proceedings were opened by the Hon. Secretary reading a report of the meeting held on the 4th March, when the paper itself was read.

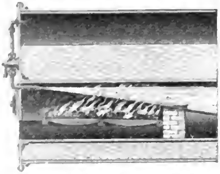
Mr. Brett read a short paper in extension of his original paper, with special reference to experiments on friction and the best system of lubrication.

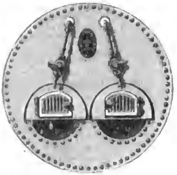
An interesting discussion ensued on the whole subject of friction, after which a lively conversation took place, in which most of the members present took part, and some experiences were detailed, serving to illustrate the various aspects of the questions which had been raised in the course of the discussion, as well as at the former meeting when the original paper was read.

The meeting closed with the usual votes of thanks.

SMOKE PREVENTION FOR MARINE BOILERS.

WHAT has proved to be a very efficient appliance for the prevention of smoke, and which is equally applicable both for land and marine boilers, has been introduced by the Whittle Steam Injector Co., of Manchester. This appliance is of a very simple character, and it can scarcely be said that it introduces any really new principle, but rather that it is the scientific application of a principle long since adopted, but until now with only indifferent results. This appliance, of which we give an illustration as it is fitted to a Lancashire boiler, is simply a steam injector placed inside a boiler flue, and consists of a nozzle with a hole about $\frac{1}{4}$ in. diameter fixed in the upper part of the furnace front in such a way that the steam, when blown in, passes along the furnace under the crown. In applying this injector to the ordinary types of marine boiler, the steam is taken from the steam space of the boiler, and the jet enters under the crown of the flue. The nozzle is coupled to a copper pipe with a stop tap by which a jet of steam can be regulated according to requirements. When coal is freshly thrown on the fire the steam is turned on and the great speed at which it enters creates an upward current from the ashpit, and a rapid combustion ensues. In raising steam rapidly to meet sudden requirements it has also proved very successful, and it appears to be, indeed, reliable practically in almost all emergencies. The West Hartlepool Steel and Iron Co. have just fitted their seven marine boilers and one Galloway boiler with this appliance, with the object of consuming smoke, saving fuel, and increasing steam, and although they have so far only had a comparatively short trial, the company state that they have certainly increased the steam and made the boilers practically smokeless, but they have not yet had time to judge whether there is any actual saving of coal, although they have had a much brighter fire. Several similar appliances have also been ordered by the Manchester Ship Canal Co. to be fitted upon their steamers and tug-boats, and certainly these injectors possess a special advantage for river steamers and vessels used on canals or inland waters where the emission of black smoke from the funnels is so great a nuisance. The special advantages claimed for this smoke preventer, when applied for steamship purposes, are that an increased power is obtained with the same consumption of coal, an improved draught, more steam, better combustion, less stoking, and cooler stokeholds. It is particularly adaptable for steamships trading in the tropics, owing to the improved draught which is secured, and having no complicated machinery it is easily applied to any existing boilers.





McMASTER AND TINLEY'S PATENT AUTOMATIC SAFETY VALVE.

IT is well-known to engineers that with the high pressures such as are now common in steamships, deposit takes place much more rapidly in marine boilers than formerly (when a lower pressure was used), with the result of collapsed furnaces, and any arrangement which will in any way lessen the risk, and prevent the damage likely to result from such an accident as the collapse of furnaces in boilers, is certainly worthy the attention of all interested in marine or land boilers.

To those interested in steamships particularly, as owing to the competition at present existing between steamships, a delay in port to repair a collapsed furnace (not to speak of the risk of the loss of the ship and life at sea) must be a very heavy loss to the owner of such vessel.

We illustrate McMaster & Tinley's patent automatic safety valve designed to prevent the total collapse of furnaces, and which for simplicity and the facility with which it can be fitted to existing boilers must instantly commend itself to everyone interested in such. It has been fitted (although just out) to the new s.s. *Minnie Hinde*, built and engined by Messrs. McIlwaine & Maccoll, Limited, Belfast, and Mr. Grainger's line of steamers, and a number of orders are in hand, it having won the approval of all engineers who have examined it.

The manner in which the patent automatic safety valve is fitted to land and marine boilers is shown in the accompanying illustration, Fig. 2 showing arrangement in marine boilers, and Fig. 3 in land boilers. Fig. 1 represents the valve and all connections in working order (all parts except the spring being of brass). The valve seat A is screwed into the furnace or other part of the boiler shown at G; when the furnace is a corrugated one, this is fitted on the top of a corrugation, and about two-thirds the length of the fire bars from the front end of the boiler, the valve B sitting in the seat, the valve face being at E, the upper part of the arrangement consists of a bridge or hanger as shown at H on Figs. 1, 2, and 3, the guide J being held in position by the nut I, the strain or tightness being obtained by the compression of the spring C; between the collar on J and the bridge or hanger H, a spindle D passes through the guide J screwed as shown, the end of this spindle resting in the valve B, through which and the spindle the cotter F is passed; the spindle D, as shown in the different figures, is lengthened to suit the fitting of these safety valves to combustion chamber tops, or the tops of furnaces in land boilers. When fitted there is a clearance of $\frac{5}{16}$ of an inch between the top side of the cotter F and the valve, and $\frac{1}{16}$ between the bottom side and the valve, see Fig. 1. Any expansion of the furnace is taken up by the compression of the spring C through the spindle rising.

In Fig. 2 the bridge H is generally a channel or angle iron when fitted over the furnaces. Fig. 4 is a view of valve and seat. As to its action the furnace G giving way causes the valve to open, as the cotter F when the valve touches it on the top side holds the valve up, and the seat having gone from the valve, the distance from the top of the cotter to the valve $\frac{5}{16}$ inch, the steam and water rush into the fire, extinguishing it, the space above the cotter being reduced, the valve will act sooner, this can be done to suit the wishes of any person wanting such done.

All further particulars can be obtained from the Patentees, care of J. G. Tinley, Hibernia Street, Holywood, Belfast.

MILFORD HAVEN AS A PORT FOR ATLANTIC LINERS.

THE landing of a portion of Barnum's company at Milford Haven from America, in October last, very greatly revived the discussion in favour of its being a port of call for many of the leading lines of passenger steamers between Great Britain and North America.

This question was discussed very fully in *The Times*, *Engineer*, and other newspapers. Several important facts, however, respecting it have not been publicly notified. Owing to this omission, our representative has carefully investigated the subject by not only referring to the more important publications which have appeared upon such, but by inspections at Milford, and by enquiries from shipping and other authorities

FIG. 1.

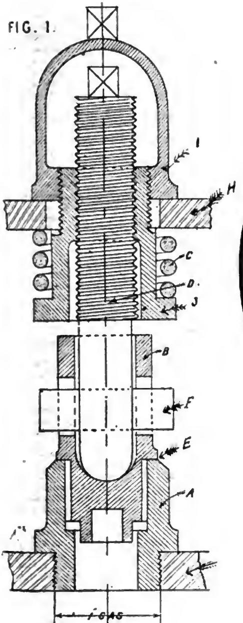


FIG. 2.

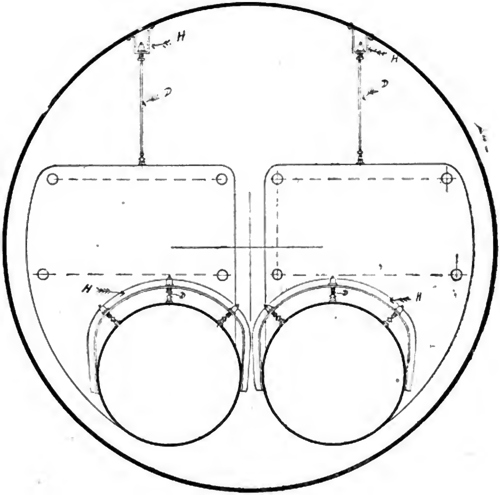
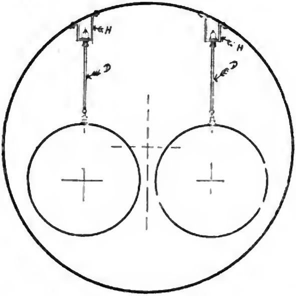


FIG. 3.



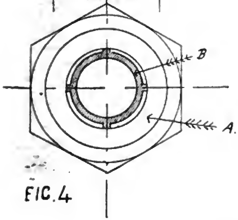


FIG. 4

McMaster & Tinley's Patent Automatic Safety Valve.—*See page 52.*

at London, Liverpool and Birmingham, as to the advantages of Atlantic liners calling at Milford.

Milford Haven is a very spacious land-locked natural harbour with an entrance upwards of a mile wide. It has a sufficient depth of water to accommodate the largest steamers, and is not obstructed by any bar, so that they can enter or leave at any time. Passengers can either embark or disembark by tender opposite the docks, or at the main dock, which has a lock of 70 ft. wide, 26 acres of water, and a quayage of more than 3,000 ft. A third place, where they may embark and be landed, is at the pier of the Milford Railway and Estate Co., Limited, which is a little further up the Haven than the Docks. There is every convenience both at the pier and docks, with some necessary improved facilities for the examination and storage of baggage, and a railway close to each in connection with the Great Western Railway Co.'s main line.

So great is the desire both by British and American passengers to make as fast voyages across the Atlantic as possible, that the quickest steamer is eagerly boarded for this purpose. To this class of voyagers the shortening of a passage between New York and Liverpool and London by an hour or two is regarded as an important advantage. Now, as Milford is only 130 miles further from New York than Queenstown, this additional distance can be made by the faster liners in about six hours. This being so, passengers could, in the event of a good express train service being provided by the Great Western Railway Co. after staying a reasonable time at Milford for refreshments, &c., and the examination of their baggage, reach towns in South Wales, the West of England, London, Birmingham, Manchester, and other Midland and North of England centres of population, and even Liverpool itself, earlier than they could be taken to the Mersey if they went up Channel, and frequently also before they could reach Holyhead, *via* Cork and Dublin.

Although only about 4¼ to 4½ hours are required to go between London and Liverpool by the best express trains, in consequence of the steamers often leaving the latter place early in the morning, both London, Birmingham and other Midland passengers have to proceed to Liverpool the day before embarkation much to their vexation, owing to hotel and other expenses and loss of time. On the other hand, if the steamers were timed to leave Milford Haven at 3.30 a.m., London passengers could, after dining, leave Paddington about 9 p.m., while Birmingham passengers could leave that town about an hour and a half later.

The United States Postal Department send mails to Great Britain by the fastest steamers. To some appreciable extent this practice has been followed by our Postmaster-General. In the event, therefore, of a fast service of steamers leaving Milford at the time mentioned, with an express train service also leaving Paddington at about 9 p.m., and other trains from the west of England, the Midlands, and the north of England in connection with it, there would, in all probability, be an immense mail traffic by these ships as the mails would be off Queenstown *en route* to New York at least four hours earlier than the Irish mail *via* Holyhead could land them at that south of Ireland port of call.

Mails from America could also be delivered in England some hours earlier *vid* Milford than *via* Queenstown and Holyhead by equal fast-speed ships and trains.

If such a scheme succeeded, there is every reason to believe that the fast steamers to be run across the Atlantic, in connection with the Pacific liners of the Canadian Pacific Railways Co., would make Milford a port of call for passengers and mails.

Passengers between the centre and south of Ireland and the United States and Canada, who made their voyage between Ireland and America *vid* Milford, could probably be conveyed to and from Milford by the steamers of the Great Western Railway Co., which run between that place and Waterford. This company are quite prepared to grant excellent facilities in connection with the proposed new service between Milford and America.

A large trade may be done at Milford in the shipment of light and valuable goods from London and Birmingham and other places, and tin plates from Swansea. As regards import trade, perishable articles, as fresh meat, bacon, ham, cheese, fruit, &c., might profitably be landed at Milford for conveyance by railway to London and other places in England and Wales.

Leading representatives of fast passenger steamship companies at Liverpool readily admit that Milford has a great advantage over Liverpool in the saving of time in landing and embarking Atlantic passengers, owing to there being no bar at Milford as at Liverpool to delay this process. They consider the fact that steamers of any size can enter and leave the haven at any time as the leading advantage of Milford. While all these Liverpool representatives state that Milford will not in the near future be made a port of call for Atlantic steamers, they cannot offer any good reason in support of their statement beyond the fact that facilities do not exist there for the expeditions landing and embarkation of passengers, mails and goods. One of these representatives admitted that if Milford did possess these advantages she would probably succeed in securing a considerable portion of the Atlantic traffic to and from Liverpool. Two other representatives of leading passenger lines between Liverpool and New York stated that if Milford is to succeed as a port of call for fast Atlantic steamships they must either start originally in this country from Liverpool or Milford itself, and not from London or Plymouth, and that the steamers to be successful must be as fast, at the least, as the fastest now afloat. They added that it would be difficult to obtain enough cargo for steamers which started originally from Milford.

It has been stated on the highest authority that a syndicate is already formed in the United States to provide a line of the fastest ocean ships, having a minimum speed of 21 knots an hour, to run between New York and Milford direct, not only for the conveyance of mails and passengers, but light and perishable goods at a reduced rate. Plans are now being prepared for this service, which will be quite a new departure in oceanic passenger ship traffic in several respects. We believe that the ships for this line will be built in the United States. With the view of further reducing the speed to a very appreciable extent across the Atlantic another scheme has been adopted. This has reference to the project of running as soon as possible a remarkably fast steamer between England and Labrador.

A company has been formed for this purpose, and a Bill constituting it for such object has already passed the Dominion Parliament, and is now before the Senate.

The promoters aim to reduce the length of the Atlantic voyage to about 1,700 miles, as against the 3,052 miles and upwards, now run by passenger steamers between Liverpool and New York. This object they propose to accomplish by making a railway along the north shore of the River and Gulf of St. Lawrence from Quebec to St. Charles' Bay, on the Labrador coast, a distance of 844 miles.

The promoters of the scheme are fully convinced that, with steamers propelled at 20 knots an hour, the voyage between Milford Haven and St. Charles' Bay, which is only 1,700 miles, can be made in three days thirteen hours. This time is much shorter than that required to make the faster voyages between Liverpool and New York, which averages six days eight-and-a-half hours.

It is expected that if this projected new route should be successful it will not only take the bulk of the Western passenger traffic, but the greater proportion of Western perishable freight, inasmuch as it is proposed to cover the distance between Chicago and London in six days. If frozen water or icebergs, to which far too little attention has been given by the promoters, do not impede the fast voyages intended, and the space between Milford Haven and St. Charles' Bay can be traversed in the time proposed by the company, it is reasonable to believe that the time of making passages between England and Japan and China would be much shorter than that in which the Canadian Pacific Railway Co. propose to carry British passengers and mails between English ports and the far East in a year or so hence when their new steamers, now being built at Barrow-in-Furness, run on the Pacific, between Vancouver and Hong Kong *vid* Yokohama and Shanghai. It appears, says a contemporary, from the names of those who are promoting this grand scheme that it is an honest commercial undertaking, and that it will be carried on very energetically. The capital of the company is £4,000,000, and about £600,000 or £800,000 as Government aid to the scheme is expected from the federal authorities at Ottawa. It is also expected that the Government of the Province will vote a substantial sum of money as a further aid to the undertaking, as the local government will derive great benefits from the construction of the railway in consequence of the opening and working of immense mines and guano deposits and quarries of marble and other ornamental stone which exist in the district through which the railway is to run. It does not appear to have been decided when the ships for the proposed line are to be built It is possible that some of our faster Transatlantic "greyhounds" may be hired for the service if the steamers are not built in the United Kingdom.

INDUCED DRAUGHT.

THE first of a series of experiments with induced draught has just been concluded at the Admiralty dockyards at Portsmouth. These experiments have been carried out by the Admiralty authorities themselves under the superintendence of Mr. W. A. Martin, of the well-known firm of Messrs. W. A. Martin & Co., furnace engineers, of Pocock Street, Blackfriars Road, who has introduced and patented a system of induced draught as applied to marine boilers. The question of applying artificial draught to these boilers has occupied a great deal of attention lately, and *forced* draught, with closed stokeholds has been with more or less success applied to vessels both in the Navy and Mercantile Marine. A closed stokehold, however, at any time, and especially when a vessel is in the tropics, is not altogether an unmitigated blessing to the men working in it, and we can't help thinking that any system that would do away with this would be welcomed by all concerned as a very decided improvement, especially if that system proved to be more efficient in taking increased work out of the boilers at a less expenditure of fuel. This Mr. Martin's *Induced Draught* has been proved to effectually do; and under his system the stokehold, open as it is to the free air, becomes almost the coolest place in the ship.

The boiler selected for these experiments at Portsmouth is one of the ten which were condemned and removed from H.M.S. *Polyphemus*. They are of the locomotive class, the only difference being that the fire-box is divided by a water partition up to 9 in. from the tube plate, which carries 156 tubes 1½ in. inside diameter and 8 ft. 6 in. long. The two furnaces are 23 in. wide and 5 ft. 6 in. long.

There is nothing remarkable about these boilers, or any reason why they should not have answered the purpose for which they were made. They failed not from any fault in construction but from the manner in which they were worked. Perhaps it would be impossible to design a boiler less suitable for standing the influences of *Forced Draught*, the only marvel is why the designer did not make himself acquainted with the principles of forced draught before incurring so much trouble and expense in fitting them in a ship. However, being in the ship they were so severely tried before being rejected that they were rendered almost worthless, the injury being internal, in the fire-box, tube plate, and tubes. The one placed in the sail-loft boiler-house for light duties was deemed to be sufficiently sound for induced draught experiments, and accordingly all the appliances were fitted to it and several experiments made. It was, however, found that after a few hours' steaming on the occasion of the last of the trials, the tube plate leaked, and it was found that retubing would be necessary before the boiler could be used for further experiments. This is being done and the trials will be continued. Three trials have been made, the first on March 20th, and the second and third on April 2nd and 10th. The results we give in tabulated form:—

TRIAL OF ex "POLYPHEMUS" BOILER.

PORTSMOUTH DOCKYARD.

INDUCED DRAUGHT. RATES PER HOUR.

	1890.		
Date of Trial	Mar. 20.	April 2.	April 10.
Llbs. of Coal consumed	840	771	802
„ „ per sq. ft. of grate	51·5	39	40·5
„ Water evaporated	8419·2	7075	7902·5
„ „ „ per sq. ft. of grate at actual temp.	516	357	390
Llbs. of Water evaporated per sq. ft. of grate at 212°	604	416·9	465
Llbs. of Water evaporated per lb. of coal at actual temp.	10	9·17	9·84
Llbs. of Water evaporated per lb. of coal at 212°	11·75	10·7	11·49
Llbs of Water evaporated per sq. ft. of heating surface at actual temp.	9·16	7·7	8·9
Llbs of Water evaporated per sq. ft. of heating surface at 212°	10·73	9·0	10·38
Average temperature of feed	46°	50°	50°
„ pressure of steam	70 lbs	70 lbs	70 lbs
Areas of fire grates	16·32	19·8	19·8
Horse power	420	354	395

The experience gained in these trials may be new to marine engineers, but they are of everyday practice to locomotive engineers. In the first instance, all anxiety about the boiler can be laid aside as well as all fine ideas about stoking. It is well known that the stoker on a locomotive fills up the furnace before going out with a heavy train, the fires being often over 3 ft. thick, but he has no fear about draught, as he knows the boiler can take care of itself in that respect, and there are no leaky tubes or burnt fire-boxes to be dreaded. This is the effect of *induced* draught, but were the process reversed and the attempt made to get a locomotive out of a station by *forced* draught with a fire-box full of green coal 3 ft. thick, it would be found to be an impossibility. In marine practice with forced draught, thick fires mean difficulty and danger. A shovelfull of coal too much loads the air spaces, and impedes the flow of air to the fire, calling for attention and skill in the management most trying to stokers, to say nothing of the danger incurred. Induced draught opens up freedom of action. In the experiments we are dealing with it was found impossible to choke the furnace, and it was found that *half* the draught power at command would overpower the furnaces, so it was regulated to burn about 40 lbs. of coal per foot of grate per hour. Every appliance for indicating results was attached to the boiler, so that the fullest information was obtained, and the results proved to be highly satisfactory, and in some instances surprising. The damaged state of the fire-box, however, prevented the boiler from steaming up to its full power of 550 H.P., but the experience gained so far shows that the faster the steaming the greater is the economy—but there is of course a maximum—and an important consideration is to have suitable furnaces that can be easily managed. The difference between induced and ordinary draught is to double the boiler power with ease, and it may be trebled without incurring the slightest damage to the boiler. The coal, too, gives a higher rate of duty than is generally obtained, because with induced draught the gases are thoroughly consumed, and not allowed to escape for want of power to efficiently burn the coal, as is the case with either natural or forced draught.

H.M.S. "BARRACOUTA."

THE investigation into the cause of the accident which occurred on board this vessel while she was undergoing her machinery contractors' natural draught-steam trials at sea on the 7th February last having now been completed, it may be well to give our numerous readers a summary of the facts brought out in evidence as well as the conclusions to which that evidence most undoubtedly points.

Although the enquiry took the form of a coroner's inquest on the body of poor Henry Ovenden, one of the victims of the accident, yet it was to all intents and purposes a Government inquiry into the cause of the accident. It was held at Sheerness by W. J. Harris, Esq., coroner for the Sittingbourne district of Kent, with the usual jury of fifteen, and Mr. Harris had for his assessor, on behalf of the Home Office, Mr. T. A. Crompton, of the firm of Messrs. Crompton, Ullstrom & Compton, marine engineers, naval architects, &c., of 19, Gracechurch Street, London. The enquiry extended over nine days, between the 18th of February and the 10th of April, having to be adjourned during that time for various intervals to allow of the attendance of witnesses, who were more or less injured by the accident. Mr. G. W. Manuel, of the P. & O. Co., as expert to the Admiralty, and Mr. W. Parker, as representing the Palmer's Shipbuilding Co., the contractors for the machinery, engines, and boilers of the *Barracouta*, also attended the enquiry, as well as a number of the officials of the navy and engineering department at Whitehall. It will be remembered that on the morning of the 7th February last, when the *Barracouta* had been at sea for some hour or two, flames suddenly issued from the ashpits of the port boiler, causing eventually the death of two of the stokers and serious injury to many others. At the time the cause of this was quite unknown and unaccounted for, but the subsequent investigations, now completed, clearly prove that cause to be a very simple one, namely the want of water in the boiler and the consequent overheating of the tube plates and the roof of the combustion chamber.

How this was allowed to take place can only be accounted for by carelessness on the part of those in charge of the feed supply, and we think also on account of defective water glass gauges. The boiler in question was fitted with three of these. Attached to the stop-cocks that shut off the water to these gauge glasses, there is a system of connecting rods and levers, so constructed that it is almost impossible accurately to test with absolute certainty the correct height of water in her boiler. These appliances no doubt facilitate manipulation, but they are at the same time liable to mislead the person in charge of the boiler-feed without his noticing it, as derangements can easily be transmitted to the stop-cocks by the merest touch of the levers. The glasses proper seem to have been negligently fitted, as the one on the after midship line bulkhead, upon which most reliance seems to have been placed by those in charge of the feed arrangements, had, on examination, only a sixteenth of an inch clearance in place of an inch and a quarter, as it should be at the top orifice. As to Fleet Engineer Hall's share in the business, as representing the chief inspector of machinery of the Steam Reserve, we have nothing to say, as the censure passed on him by the jury is we think sufficiently severe.

It is matter of satisfaction, however, to think that the boiler itself was in all its parts structurally well put together, and that the most rigid examination only proved that want of water was the sole cause of the accident. There can be no doubt, we think, that the intense heat, acting upon the tube plates uncovered by water, caused them to overheat and consequently distort, and this of course would be at once followed by a contraction of the tubes, and thus allow sufficient steam and water to escape into the combustion chamber to form pressure enough to overpower the natural draught, by preventing the passage of the flames through the tubes, and forcing them out of the ashpits, through the fire-bars, into the stokeholds.

The starboard boiler was found in perfect condition, and in all respects fitted for its work, and had the port boiler received the same attention, we have little doubt that no accident would have happened. It is further satisfactory to know that the reports of the expert engineers on all important points agreed, and we think that the verdict of the jury, who so patiently and intelligently followed the evidence, will be endorsed by all practical engineers. That verdict was, "That the deceased, Henry Ovenden, accidentally came to his death from shock from burns received in the stokehold of H.M.S. *Barracouta*, caused by flames suddenly issuing from the ashpits of the port boiler, owing to the combustion chamber tubes and tube-plates having been injured by reason of the tubes and plates becoming over-heated from shortness of water, or ebullition in the boiler, thereby producing local expansion and contraction, and allowing the steam to escape into the combustion chamber, and cut off the exit of the flames through the tubes."

With the riders which the jury appended to their verdict we quite agree, and we shall now look forward with considerable interest to the report which the assessor, Mr. Crompton, will make to the Home Secretary, and we have no doubt when it appears, from that gentleman's long experience and well-known ability in matters appertaining to marine engineering, that it will be an exhaustive and thoroughly reliable one.

S.S. "MAJESTIC."

THIS splendid specimen of naval architecture and marine engineering has beaten the record on her outward and homeward maiden passages, and much better results are expected of her. The slight alterations made in her by her builders have been in every way successful. She left the Mersey at 7.40 p.m. on 2nd April, bound for Queenstown, at which port she arrived in twelve hours, though not driven up to her speed. Queenstown was left behind and Roches point passed at 2.25 p.m. on 3rd April, and she arrived at Sandy Hook at 8.15 p.m. on 9th April, her time from Queenstown being 6 days 10½ hours. Runs each days as per official log:—first day, 420 miles; second, 444 miles; third, 467 miles; fourth, 412 miles; fifth, 455 miles; sixth, 471 miles; total 2,669 miles = 17·21 per hour. She encountered strong headwinds the whole voyage and kept a southerly course to keep clear of icebergs.

She left dock at New York on April 16th at 3.22 p.m. on her homeward voyage, passed Sandy Hook at 5 p.m., run to noon on 17th, 343 miles; 18th, 434 miles; 19th, 431 miles; 20th, 448 miles; 21st, 437 miles; 22nd, 442 miles; 23rd, arrived off Queenstown at 6.58 a.m., run to that hour 347 miles; total, 2,881 miles. A southerly route was also taken on the route home to avoid icebergs, consequently the distance traversed was one hundred miles longer than it might have been. The machinery ran very smoothly, with an entire absence of vibration.

THE ACCIDENT TO THE "CITY OF PARIS."

WE present with this issue two bird's-eye views of the starboard engine-room of the *City of Paris*, from photographs generously placed at our disposal by the English agents of the Inman and International Steamship Co. Was ever such chaos seen before in an engine-room? We have seen many breakdowns in our time, but never such a smash up. The cylinder of the low-pressure engine, 113 in. in diameter and weighing 45 tons, is broken into pieces; one broken part, nearly half, is conspicuous in the centre of one of the pictures, and the other chief part in the right-hand background of the same picture. The entire cylinder in the background of the other picture still stands vertically in place, and is the intermediate expansion cylinder of the three triple-expansion cylinders forming the complete engine. The fragments of the largest low-pressure cylinder must be looked for in the chaos of *débris* below in the foreground. In this picture also will be seen the crank and big end of the connecting rod, above which stood originally the destroyed low-pressure cylinder, the piston rod, and bent dummy rod being folded back over the connecting rod. This dummy rod or tail rod, passing originally through a gland in the top cover of the cylinder, is 7 in. in diameter and of mild steel, and is bent round into a semi-circle like a bit of wire. The vertical A frames, weighing six tons each, on which the low-pressure cylinder was mounted to a height of 45 feet, cannot be distinguished in the *débris*, as it is a mere heap of scrap. The destruction is almost incredible; everything that would break is broken, and everything that would not break is broken or twisted. It presents more the appearance of an engine blown to pieces by one of the 110-ton shells, or by dynamite, than an ordinary breakdown.

If we but think of the circumstances in which the breakdown took place, we need not, however, wonder at the destruction. These gigantic engines, with their set of duplicates on the larboard side of the vessel, are tearing away full speed at 85 revolutions a minute on the wide Atlantic, all going well and smoothly, when crack goes the propeller shaft without a moment's warning, the engines tear away, racing at perhaps double their former speed with no resistance on them, crack goes the piston of the low-pressure cylinder, which jams across the cylinder, and on the next downward travel of the rod, frantically driven by the other two effective cylinders, right through the bottom cover, pulling down the cylinders and A frames on top of the crank, which then, still driven at 150 lbs. steam pressure in the high and intermediate cylinders, proceeds to break up all castings coming within reach of it, whilst the connecting rod and piston still attached to the crank and crosshead respectively thrash about the place like a gigantic flail of some 12 tons weight; and this destruction continues until the steam can be cut off from the engines by the engineers. And how has the vessel withstood this tremendous racket in its intestines. All honour to the builders of that grand vessel the *City of Paris*, and to the owners of such a splendidly designed and constructed vessel, not a hole in her skin nor a leak in her seams, and had it not been a slight side accident, the vessel as a seaworthy craft would not have been a pin the worse. Some part of the falling engine or revolving crank and connecting rod carried away the side of the condenser which is under water-line and in communication by a large valve with the sea. The circulating water poured into the engine-room and as holes had also been knocked through the partition bulkhead between the two engine-rooms, the water gradually flooded both engine-rooms and stopped the noble vessel's career in mid-Atlantic. However, so well and stoutly were her compartment bulkheads built that she was towed safely home to Queenstown with two compartments flooded, and was able eventually to steam home with her larboard engine and propeller to Liverpool. What primarily caused the breakdown of her propeller shaft may still remain an unsolved question, but as it has been reported that the shaft had accidently dropped between the stern post and thrust block, this may have accounted for unexpected and abnormal strains upon it and its consequent fracture.

"THE AUGUSTA VICTORIA."

OWING to the circumstance that some of the huge vessels now owned by the Hamburg-American Steam Packet Co. have outgrown the dry dock accommodation available at the home ports, the twin-screw steamer *Augusta Victoria* paid a brief visit to the Thames the beginning of last month, and, taking advantage of the opportunity, Messrs. Smith, Sundius & Co., the London agents of the owners, invited a number of gentlemen interested in the transatlantic passenger traffic to inspect the vessel. The party, which was under the personal direction of Mr. C. T. Sisley, were conveyed from Fenchurch Street to Tilbury in carriages specially provided for the occasion, and, the ship being still in dry dock, every facility was afforded for an examination of both her interior and exterior. The visitors were most courteously received by Captain Albers and the other officers, who were untiring in furnishing every information and in explaining the many noteworthy features of what is undoubtedly a very fine example of modern shipbuilding.

The *Augusta Victoria*, like the *Columbia* and the other vessels belonging to the Hamburg-American Co., has been specially designed to meet the requirements and convenience of transatlantic passengers—safety, comfort, and speed being the primary considerations. In all material particulars she is a sister ship to the *Columbia*, of which it is said that in the race to New York she has only been beaten by the *City of Paris*. But while the *Columbia* is British-built, having been launched at Birkenhead last year, the *Augusta Victoria* was contructed by the Vulcan Co., of Stettin, and is, we believe, entitled to the credit of having made the fastest maiden trip on record. She is a handsomely-modelled vessel of 8,000 tons, constructed throughout of mild steel, and fitted with twin triple-expansion engines of 12,500 H.P. She is 460 ft. long, 56 ft. broad, and 39 ft. deep; and has three pole masts and three oval funnels. The ship may be described as flush-decked, with topgallant forecastle, poop, and long bridge-house, the roof of which is extended to the sides, forming the promenade deck, which is 350 ft. in length. She is built to the requirements of the Bureau Veritas. There are four complete decks, and accommodation is provided for 364 first-class, 116 second-class, and 695 steerage passengers, while the crew, including stewards and engine-room hands, consist of about 220 persons. On the upper deck forward is the forecastle, plated over, giving a large open deck for working anchors, &c., on the after end of which are fitted the breakwaters and lighthouses. Abaft the forecastle is the fore hatchway, surrounded by a deck-house to give greater protection to the steerage passengers. Abaft the fore-hatch is the long deck-house, which extends to the after hatch. In this deck-house is the first-class dining-hall. It is decorated in the highest style of mixed Renaissance. Below this, on the main deck, is another first-class saloon. The decoration is throughout of the most sumptuous and lavish character. The panel painting and mirrors in these saloons are used with fine effect, and the upholstery is very elegant in style and colour. Above the deck-house on the promenade deck are the ladies' room and music-room, both decorated in the rococco style, smoking-room, bar, state rooms, captain's and officers' rooms. It is impossible to give a full description of the several saloons, &c., on board. All the decorations are really works of the highest art, and the designs are by the best artists of the German school. The furniture and the whole of the decorative work has been supplied by Bembe, of Mayence, and is in strict keeping with the style of decoration. The second-class accommodation is also unusually good—in fact, equal to the first-class of many Atlantic boats. There is a dining-hall on the upper deck, and stairways giving access to the ladies' room and smoking-room in the after end of the promenade deck. The panels of these rooms are carved by hand in hard wood, and most handsomely decorated. The first-class smoking-room is a luxurious apartment on the promenade deck; it is upholstered in green morocco. In the music-room is a very handsome grand piano. Nothing can exceed the elegance and good taste displayed in furnishing this room. Large oil paintings, mirrors, rich hangings of silk and damask, combine to make it a most luxurious chamber. A great feature in the passenger accommodation is the number of cabins on the upper and promenade decks, and that in bad weather it is never necessary for anyone to go on deck. A passenger can obtain access to any part of the ship without being exposed to the weather; and none of the doors of the state rooms open on to the weather deck. The propelling machinery, of which a detailed description is also impossible on this occasion, drives the vessel at a speed of something over 19 knots an hour, and she makes the trip from Southampton to New York in seven days. It should be added that the ship is lighted throughout by the electric light, the installation being unusually complete even for an Atlantic liner; and, in the matter of boats, life-saving appliances, &c., every provision has been made which experience suggests and permits for the safety of all on board.

The foregoing very general particulars suffice to show the character of the *Augusta Victoria*, and at the inspection the universal opinion expressed was that, having regard to the accommodation provided, the Hamburg-American Co. may rely upon a very appreciable share of the passenger-carrying trade between New York and this country. It is well known that a large section of the ocean-travelling public is quite willing to pay liberally for speed and comfort, and even luxury, on shipboard. It is claimed for the *Augusta Victoria* and the other vessels of her fleet that they afford passengers almost the maximum amount of comfort which modern science and ingenuity have rendered possible at sea, and with a competing service of this class there need be no fear of the great Liverpool lines securing a monopoly of the transatlantic traffic.

SAND-PUMP DREDGING AND THE MERSEY BAR.

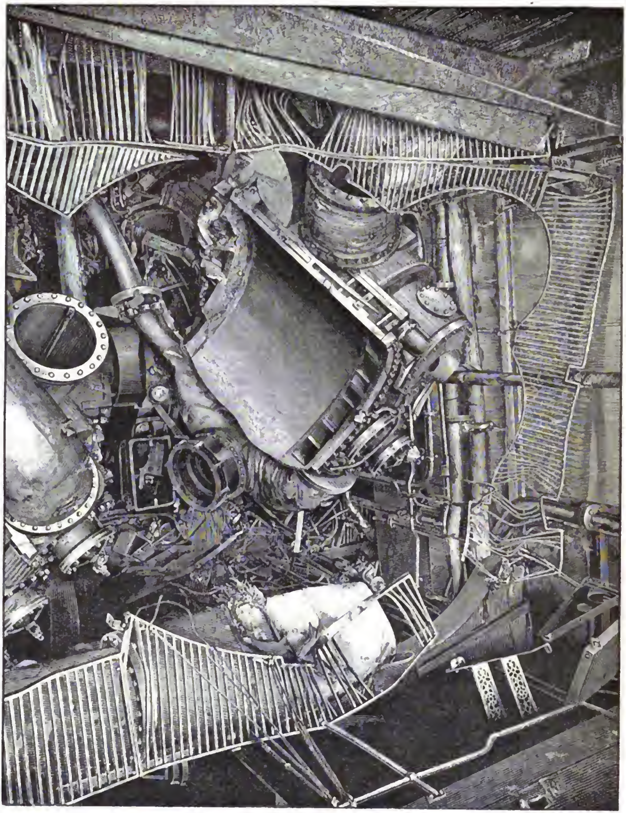
THE sand-pump dredger *Beaver*, built by Messrs. Simons & Co., Renfrew, has, according to *Engineering*, been doing good work at Natal. The vessel has two 18 in. centrifugal pumps, with suction pipes. The two pumps work independently, and are driven from the propelling machinery by shafting. The tubes are each 67 ft. 6 in. long, and can dredge sand at a depth of 40 ft. from the water level. Great care was taken in designing the pump discs. They work to 150 revolutions per minute and absorb 180 I.H.P. At this speed they can raise fully 1,000 tons per hour. The engineer of the Natal Board, in reporting on the work of the *Beaver*, states that the vessel is doing good service. In one week she lifted 10,500 tons, and discharged over the bar 10,000 tons, and towed outside seven barges containing about 100 tons each. The time dredging was 24 hours 30 minutes. Time slipping moorings, depositing the spoil, and picking up moorings again, 37 hours 15 minutes, or a total of 61 hours 45 minutes, and the first load lifted was in 45 minutes, or equal to 666 tons per hour, with one pump working all the time. The engineer adds—"We could certainly do more if we could get back to the moorings without being delayed, but the crowded state of the harbour renders it difficult to get back, and a lot of time is lost thereby." The best single day's work done by the *Beaver* was five loads, or 2,500 tons raised and discharged about four miles off. The usual ten-hour day's work is raising five loads and discharging four loads, or *vice versa*. The result of the work at Natal of the *Beaver* and a bucket-ladder dredger *Otter*, also built by Messrs. Simons, has been that whereas several years ago the ships trading to Natal were of about 400 tons, steamers of 1,700 tons and drawing 16 ft. of water can now safely go up to the wharves. The *Otter* is making a channel 300 feet wide, and has in a short time increased the depth from 16 feet to 18 feet over the whole area, and the desired depth (22 feet) will doubtless be obtained shortly. These facts must be encouraging to the people of Liverpool, as they augur well for the success of their project to remove the barrier which, if taken away, would raise their port to rank among the finest in the world. As is now pretty well known, Messrs. Simons are designing and constructing for them sand pumping machinery similar to that in the *Beaver*, which makes her results the more interesting. The work of dredging at the bar is to be carried out under the direction of Mr. George Fosbery Lyster, M. Inst. C.E., engineer to the Mersey Docks Board. It is intended to begin with a set of pumps to raise 500 tons per hour, and to work in depths ranging from 10 feet to 35 feet, but doubtless when the advantage is established more extensive plant will be employed to facilitate the work and make the proposed channel wider and deeper. The dredging material will be discharged into the hopper of the barge, which has capacity for 500 tons.

With reference to the dredging done by the Preston dredger, as mentioned in last week's issue of *Engineering*, we are informed that the Bombay dredger in December last raised 112,000 tons in 105¼ working hours, which is nearly double that done by the Preston dredger.

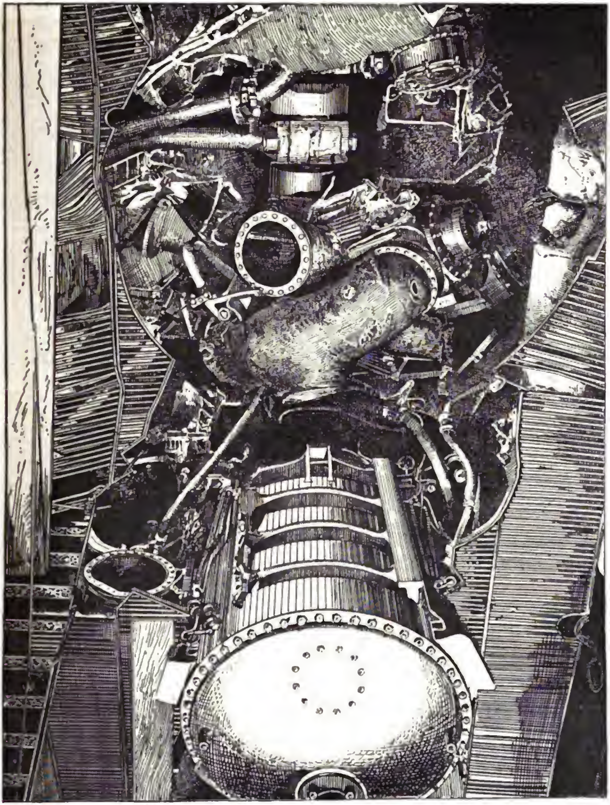
THE GIBSON AUTOMATIC BELL-BUOY.

THE dangers attending the navigation of the "mighty deep" are so numerous that anything in the shape of a warning to ward off the mariner from the shoals and rocks that beset the coast waters of all countries is a blessing indeed.

The latest of these guardian warnings comes to us in the



The Starboard Engine of the S.S.



"City of Paris" after the Accident.—*For description, see page 56.*

form of a Bell-buoy, invented by Mr. Jasper Gibson, of 51, Lincoln Inn Fields, London. This buoy carries two bells in the form of a combined storm bell and fog bell. The former surmounts the buoy proper and has three external hammers suspended from a horizontal swinging disc, so balanced that each hammer after striking the bell falls away from it, leaving the bell to give out its full tone, thus avoiding the defect of the ordinary bell-buoy, where the hammers remain against the bell for a second or two, especially in rough weather, and, of course, deadening its sound.

The fog bell is a very ingenious contrivance. At the between wind and water float line of the buoy four openings are made, which allow every small surface motion of the water, which would not affect the buoy itself, to actuate a simple but ingeniously constructed float carrying a vertical spindle, to accumulatate power which causes, at regular intervals, a hammer to strike the bell. This hammer after giving its blow is at once drawn back, thus allowing, as in the case of the storm bell, the fog bell to give out its tone clear and distinct. This may be done two, three, or six times in a minute, according to the arrangements of mechanism, but we believe that three times a minute is the proposed number for this buoy, although twice would be quite sufficient.

The efficiency of this bell-buoy has been tested both at the entrance of the Surrey Commercial Docks and the Royal Albert Docks, with, we understand, the utmost success, and several of the leading Trinity House pilots, who have seen the working of Mr. Gibson's buoy, have recorded their opinion that it is well adapted for supplying a felt want, and that its general adoption would prove of great importance in warning ships when approaching danger in thick or foggy weather. It certainly is a very great improvement on any other bell-buoy, and both in storm and fog will prove a great aid to seamen in navigating their vessels when approaching or leaving land.

We understand that a system of distinguishing one buoy-bell from another by sound, is comprised in the protection obtained by Mr. Gibson from the patent office, and if this is carried to a practical issue, it will of course add greatly to the value of his invention.

THE NEW PADDLE STEAMER "PRINCESS VICTORIA."

THIS handsome and swift vessel has just been completed by Messrs. Wm. Denny & Brothers, Dumbarton, to the order of the Port Patrick and Wigtownshire Railways Joint Committee. She is intended for their service between Lorne and Stranraer, and on the 24th April she went down the Clyde on her final trial trip with a large company on board, amongst whom were the Earl of Antrim, Mr. G. W. Wolff, of Messrs. Harland & Wolff, Belfast, who built the previous boat for this service, Mr. P. Denny, Jr., and various other members of the building firm, also a numerous company of engineers and shipbuilders belonging to the Clyde and other centres. The steamer made four runs on the measured mile, and attained an average speed of 19·65 knots per hour. Upon the last run she attained the speed of 20 knots, equal to 23 land miles per hour. The steamer, in addition to being a superbly fitted passenger vessel, can accommodate 750 head of cattle, and has, over and above, ample room for a large number of horses. The principal dimensions are:—280 ft. by 35 ft. 6 in., by 22 ft. to promenade deck; gross tonnage, fully 1,000 tons. She has lower, main, poop, bridge, and forecastle decks, with seven water-tight bulkheads, all carried up to main deck. Abaft the chain locker are two trimming tanks, so as to adjust the draught of water when cattle are carried aft. A bow rudder has also been fitted so as to enable the vessel to leave the harbour with as little manœuvring as possible. This bow rudder has been used on several occasions since she left the builders' hands, and has answered perfectly; while there are two wells, one forward and one aft, for the cattle hatches. The plating is carried to the same level as the poop-bridge and forecastle decks, and fitted with large gangway doors, thus giving the vessel the appearance, when the doors are shut, of being flush-decked. The first-class passengers are all accommodated in the bridge-house forward of the machinery. The deck saloon on the main deck is the full breadth of the vessel and nearly square, having a head room of 8 ft. 6 in. It is lighted from the sides and fore end by large side lights, and ventilated in the centre by a trunk through the music saloon, with a skylight on the top. The various saloons and state rooms are fitted up in the extremely lavish manner for which Messrs. Denny have now a decided reputation.

Although 750 cattle may be carried in this vessel without crowding or affecting her speed much, the passengers will not suffer any inconvenience from the proximity of the cattle, as the spaces are all thoroughly ventilated by means of powerful fans, made by Messrs. M. Paul & Co., of Dumbarton, placed in casings, forward and aft the engine and boiler spaces. Among the other auxiliary machinery on board may be mentioned the steering gear of Messrs. Muir & Caldwell, which is situated on the fore end of the engine-room; steam windlass by Messrs. M. Paul & Co., Dumbarton, on the main deck forward, which works a capstan on the top of the forecastle deck. The windlass is also designed to act as steering gear for the bow rudder, this movement being controlled by means of handles from the forecastle deck. A combined steam and hand capstan, also by Messrs. M. Paul & Co., is fitted aft on the poop deck for warping the ship, while there are two winches, one to the fore and one to the after hatch. The electric light is fitted throughout the vessel, the dynamo being by Messrs. J. H. Holmes & Co., of Newcastle, driven by a "Tower Spherical" engine, by Messrs. Heenan & Froude. The main engines are a set of Messrs. Denny & Co.'s angular type, of which the first two examples were fitted to the highly successful Belgian steamers *Princess Josephina* and *Princess Henrietta*. They are compound surface condensing, and are supplied with steam from four ordinary marine type return tube boilers. Forced draught is supplied to the stokeholes by four of Brotherhood's three-cylinder engine fans, which are situated two forward and two aft, and are easily supervised by the engineer in charge. There are also four of Weir's pumps, two for feeding boilers and two for sundry purposes; two centrifugal pumps by Gwynne, and combined steam and hydraulic starting gear by Messrs. Brown Bros., Edinburgh. The vessel has been taken over by her energetic commander, Captain Campbell and his crew, and will probably enter on active service next week. There is no doubt that the vessel is a great advance, both in arrangements and speed upon any other at present in the Irish Channel trade.

STEAMSHIPS.

FROM Messrs. H. E. Moss & Co's circular:—The activity in the shipbuilding and engineering industries mentioned in our circular August 21, 1889, has continued throughout the year, making the grand total of tonnage, completed and delivered in 1889, upwards of one million and a quarter tons, and a money value of £20,000,000 sterling, but even this large sum does not represent the actual business done, as in very many instances vessels have changed hands two and even three times before registration, the increase in value over the original contract price reaching the respectable profit of 15 to 30 per cent. The result, however, to the shipbuilder and engineer of this large volume of trade cannot be said to be satisfactory, the statements published of various public companies and some recent failures showing they have not equally profited by a very busy year. The tonnage building in hand on January 1, 1890, was 828,000 tons, but of this we are pleased to say nearly five-eighths was for regular lines, and considerably less than one half were ordinary cargo steamers. The prices of steamers and sailers are fully 25 per cent. higher than in January, 1889, but several builders now begin to see daylight, and are eager for orders. So far, however, as prices are concerned, we do not expect any serious reduction in 1890, the large tonnage on Government account helping materially to stiffen prices. The increase of British tonnage on the year 1889 was of steamers 650,000 tons, less decrease in sailers 110,000 tons, or a net increase of 540,000 tons, but notwithstanding the considerable increase, we do not hear of any steamers being laid up, or of the general depression which prevailed in 1884-5. One effect, however, of the facts named above is apparent from the greater readiness shown by holders of secondhand vessels to realise, and buyers of this description of property can certainly get better value for their money than they could a few months since. Tonnage is strongly held, and we see no reason to fear serious consequences even if in a few isolated cases sales are forced; very few contracts have been broken through impecuniosity; and though smaller dividends are a certainty, investors may still rely on receiving a fair interest on their investments. Steel is more than ever the favourite material for hulls, but it requires greater care and more frequent painting than iron;

still the advantages gained by using it more than counterbalance its disadvantages. Foreigners are still buying largely, and the requirements of our own colonies are an important factor in all calculations. In steam tonnage we are equal to all the rest of the world, and we are by far the largest carriers for other nationalities. Prices for steel sailing ships are from £11 per register ton for large vessels to £14 for smaller, and steamers of fair average power can be built 4,000—6,000 tons at £9 10s. on deadweight capacity, and proportionately higher rates for smaller sizes. The average size of both sailers and steam is increasing every year, and a very large proportion of tonnage in construction exceeds 2,000 tons.

AILSA SHIPBUILDING CO., TROON, AND BRITISH INDIA PATRONAGE.

THE circumstance of the British India Steam Navigation Co. (which during the greater part of its history has shared almost its whole custom, in the shape of new vessels, between Messrs. Denny, of Dumbarton, and Messrs. Inglis, of Pointhouse) having entrusted the Ailsa Shipbuilding Co., of Troon, with orders for as many as eight vessels during a period of little over one and a half years, has given rise to comments in various ways and quarters. Doubtless the fact of the Marquis of Ailsa, who is joint proprietor of the shipbuilding works with the other three members of the firm carrying on its practical work, being also a shareholder in the great British India Co., may have had something to do with the Ailsa Co. procuring an introduction to the British India Co., but without doubt it is entirely due to the ability, enterprise, and skill, resulting in first-class workmanship and good speed and carrying, which the members of the building firms have evinced, that the various repeat orders for new vessels have been also secured. The fact is, both the senior managing partners in the Ailsa Co., Mr. Alex. McCreadie and Mr. P. Wallace, were for many years—the latter, indeed, during the whole of his working lifetime—in the employ of Messrs. Inglis, of Pointhouse. As chief draughtsman for that firm, Mr. Wallace had to do with the designing of the vessels built by them; while as manager of the ironwork department, Mr. McCreadie carried out the designs in practice. British India vessels were therefore in all essential respects "familiar as household words" to the members of the Ailsa Co.; and what more natural than that this fact should enable them to offer for and secure and encourage the British India Co. to place with them the contracts which have occasioned comment.

Other reasons apart, there is something peculiarly appropriate in the brisk little Ayrshire port of Troon taking lead at the present time in the matter of building high-class steel steamers for the most important shipping companies, because Troon, almost one century ago, was quite famous for its shipbuilding. Troon-built ships were for long known and admired in all parts of the world. The docks at Troon were established over eighty years ago, and for a period of over forty years the little port could boast a dock capable of taking in the largest merchant ships afloat. Troon carpenters, in consequence, had long a high reputation for skill and intelligence, so much so as to render it quite natural on the part of Dr. Norman McLeod to introduce prominently the Troon carpenter into his splendid tale of "The Old Lieutenant and his Son." Though under greatly altered conditions, the functions of the carpenter are still a prominent factor in ship construction, and Troon sustains in this respect its ancient reputation.

The latest of the series of steamers which the Ailsa Co. are building for the British India Co. was handed over to her owners about the middle of April. Our representative had the privilege of inspecting the vessel on the day on which she was tried for speed and handed over, and can speak with the greatest assurance as to the beauty of design and the neatness and substantiality of her internal fittings, which the figures he is enabled to give regarding speed and carrying are evidence sufficient as to her more utilitarian qualities. The *Kassara* on trial had a numerous party on board, and steamed from Troon to the Gareloch, Loch Long, and back to the Ayrshire coast. She had 800 tons of coal on board, a cargo considerably over half the maximum load permitted by Lloyd's freeboard scale, yet the distance between the Cumbrae and Cloch lights was accomplished in 58 minutes, being at the rate of 14·137 knots per hour. On the backward run the time taken to cover the distance was slightly more, but the average speed over the whole double run exceeded 14·1 knots This result must be said to be remarkably successful, when the limited length of the vessel, the great breadth and the fulness of form, are taken into consideration. The speed guaranteed was 13½ knots on the maximum. The dimensions of the vessel are 240 ft. by 34 ft. by 17 ft. 6 in. to main deck, or 25 ft. to shade deck. The engines, which are of the triple-expansion type, are by Messrs. Dunsmuir & Jackson, of Govan Engine Works, and gave excellent account of themselves during the whole time's steaming. The cylinders are 25 in., 40 in., and 65 in. in diameter, by 42 in. stroke. The revolutions averaged on trial 88½ per minute, and the power developed was over 2,200 indicated. Steam is supplied from two large double-ended boilers, having a working pressure of 160 lbs. per square inch. Among the numerous valuable accessories to the main engines fitted, we may mention Weir's patent feed heaters, pumps, and evaporator. The steam steering gear is by Bord & M'Lauchlan, Paisley, and 16 winches by Clarke, Chapman. The *Kassara* has excellent accommodation for 26 first and 22 second-class passengers, and the electric light is fitted throughout the whole ship; the installation consisting of, in all, 140 lamps of 16 candle-power. The generating plant consists of a "Chandler" engine, coupled to a dynamo of the "Manchester" type by a patent flexible coupling, and runs in perfect silence at a speed of 380 revolutions per minute. The whole installation reflects much credit on the engineers, Messrs. Harvie & Co., Broomielaw, Glasgow, and on their superintendent in charge, Mr. P. R. Fergus. During the course of their trip, dinner was served in the first-class saloon, Mr. M'Creadie presiding. "Success to the *Kassara*," and "Success to to the Ailsa Co.," were amongst the toasts given and duly pledged. Captain Hodgkinson, in proposing the last-named, expressed on behalf of the owners, the highest satisfaction they had in all their dealings with the Ailsa Co., whose work had in all respects been most satisfactory to them.

THE USES OF ALUMINIUM:

FACTS AND FALLACIES.

Being a supplement to the paper by JOHN H. J. DAGGER, *F.I.C., F.C.S., read before the British Association*, 1889.

NEVER since the alchemist's dream of the wondrous stone that should transmute the baser metals into shining yellow gold faded in the dawning light of modern chemistry, has the worker at the furnace and in the laboratory striven to solve a more perplexing problem than to find the flux which shall liberate the silver-like metal, aluminium, stored in abundance beyond the dreams of avarice in the common clay and rocks around us.

It is now one hundred and thirty-six years ago since Margraff proved the earth alumina to be a metallic oxide, and sixty-two years since Wöhler first obtained metallic aluminium, and thirty-six since Deville's historical experiments produced the metal *en masse* for the first time.

Modifications of Wöhler's and Deville's methods are still the chief of the processes for producing metallic aluminium, and though the uses have been so simplified that it is possible to produce the metal at a cost of 20s. per lb., it is evident these methods, involving as they do, the laborious and costly preparation of another metal, sodium, can never be the sources of the metal which, according to the enthusiastic journalists and leader writers, is to be the material of our Atlantic liners, bridges and locomotives, in the coming "Aluminium Age."

The future source of aluminium must be a method of *direct reduction*, and the first advance in this direction was the discovery by Cowles that, using the intense heat of the electric arc, it is possible to reduce aluminium directly from its ores.

Unfortunately, up to the present time, it has been found that, in absence of an alloying metal, the liberated aluminium absorbs carbon, and is converted into a carbide, and so nothing richer than 80 °/o aluminium has been obtained. Still there is every hope that at no very distant date it will be possible to overcome this difficulty, and obtain aluminium directly from the furnace.

When we remember that more than a quarter of a century elapsed before the old method of Wöhler was developed so as to yield the metal in quantity, and thirty years before Castner had so simplified it that pure aluminium could be produced in its present quantities; and that it is only four years since Cowles first announced his discovery to the Franklin Institute; and that already the process is carried on in large works in Europe and America, producing aluminium in rich alloys at half the cost of the older chemical process, it will be admitted that it is in this direction that we may most confidently look for our supplies of "silver from clay."

Before proceeding to give some account of the chief value of aluminium in the arts and industries of to-day, I will say a few words about the physical properties of the pure metal itself and its uses.

As in the infancy of all scientific discoveries, much misconception exists as to the purposes and condition under which it would be possible to use this metal, if produced as cheaply and in similar quantity to iron, and comparisons have been made which are certainly misleading. For the sake of more clearly explaining my meaning, I give below in a tabulated form, the physical data of the two metals side by side.

	ALUMINIUM.		IRON.			
			Cast.		Wrought.	Steel.
Colour	Bluish Cast	White Rolled	White.	Gray.		
Density	2 5	2·7	7—5	7—1	7—8	7—7—7—8
Tensile strength in tons per sq. in.	12	17	7	9	19—27 Boiler Plates 40—45	30—36 Rolled Bessemer 42—52 „ Crucible 50—53
Melting points ..	1300° F		..		..	
Average weight per cubic ft. in lbs.	162		450		485	490

From the above figures it will readily be seen that, although aluminium is only one-third the weight of iron, it has little more than one-half the tensile strength of the best wrought iron, and only one-third that of mild steel,—facts that would tell very materially against its replacing the metals in shipbuilding and for structural purposes. There are, of course, many circumstances in which aluminium might replace iron with advantage, but statements such as the following: An Atlantic liner built of aluminium would have one-third the draught, and can be propelled with the same engine power at double the speed that it is at present when built of iron, and bridges built of this metal would be quite as strong as if built of iron, but would be only one-third the weight—are most certainly fallacious, and likely to perpetuate the erroneous and exaggerated ideas current regarding this new and beautiful metal.

The chief demand for aluminium at present, and probably always will be, is in connection with its alloys. The use of the metal itself will be chiefly for light machinery, fittings for lighting and water supply, astronomical and scientific instruments, and art metal generally.

With copper, aluminium forms a series of beautiful alloys, varying in colour from bluish-white to red] gold and pale yellow, differing very widely in physical and mechanical properties. Those containing 60 to 70 per cent aluminium are very brittle, glass hard, and beautifully crystalline; with 50 per cent. the alloy is quite soft, but under 30 per cent. the hardness returns. The 20 per cent. bronze has a whitish-yellow tint, somewhat resembles bismuth, it is very brittle and can be pulverised in a mortar. The brittleness of alloys above 11 per cent. prevents their use, but from 11 per cent down to one per cent. they are most valuable, their physical and mechanical properties render them useful for every variety of metal work, the high price of aluminium only having restricted their use hitherto.

The following table gives the range of tensile strength and density in castings of these alloys:—

Grade.	Tensile Strength per square inch.	Elongation.	Density
"A" special (11%)	90—100,000 lbs.	0—5·0%	7·23
"A" bronze (10%)	75— 90,000 lbs.	4—14%	7·69
"B" „ (7½%)	55— 65,000 lbs.	20—40%	8·00
"C" „ (5·5½%)	35— 45,000 lbs.	30—40%	8·37
"D" „ (2½%)	30— 35,000 lbs.	40—50%	8·69
"E" „ (1¼%)	25— 30,000 lbs.	40—55%	

In resistance to compression, A grade (10 per cent.) equals the best cast steel, its tranverse strength or rigidity is about 40 times greater than ordinary brass, its limit of elasticity equals that of steel of the same tensile strength and elongation.

The following results were obtained at Waterton Arsenal, U.S.A.:—

COMPRESSION TESTS MADE IN WATERTOWN ARSENAL, U.S.A.

Original Length inches.	Increased to inches.	Original Drain inches.	Increased to inches.	Ultimate Strength.	Ultimate Strength lbs. per sq. inch.	Specimen Casting.
2·00	1·705	·798	·865	80,200	160,400	"A" 1 Bronze
2·00	1·525	·798	·914	76,800	155,600	"A" 2 Bronze

One of the most valuable properties of these alloys is the fact that they are forgeable and can be worked at a bright red heat as easily as wrought iron, all other bronzes are "hot short." The rolling of sheets, rods, bars and wire, is done at a bright heat, only the finishing is done in the cold.

A casting of "B" grade (60-65,000 lbs. per square in.), with 20 per cent. elongation, when rolled showed 83,000 lbs. with 39 per cent. elongation.

These alloys retain their strength through a high range of temperature, a quality most valuable in a metal. Their resistance to corrosion to a degree only surpassed by gold and platinum, makes them invaluable to shipbuilders, marine, hydraulic and sanitary engineers. This quality, combined with their colour, render them far superior to ordinary bronze for art metal work and statuary.

The advent of smokeless powder, with its greater corrosive action on ordinary gun-metal and steel, is already causing military engineers to look round for a material to replace these metals in the artillery and small arms of the immediate future, and in the peculiar combination of properties required, aluminium bronze is unapproachable by any other metal or alloy, and the solution of this question will undoubtedly lead to a great demand for these alloys.

The aluminium brasses are made by combining the metal with copper and zinc, yielding close grain homogeneous and remarkably tough alloys. They are made in two grades.

Aluminium Brass.	Tensile Strength in resisting, per sq. inch.	Elongation.	Density.
No. 2	30—35 tons	2— 7%	8·05
No. 3	26—27 tons	14—15%	8·15

TRANSVERSE TEST OF NO. 2 ALUMINIUM BRASS.

Section of Brass in sq. inches.	Length between Supports in inches.	Breaking Load.	Line of Elasticity.
1	12	5064 lbs. 72 cwts.	6496 lbs. 58 cwts.

These alloys can be forged hot, their special casting properties, high corrosion resistance and low specific gravities, render them most valuable for hydraulic and engineering purposes.

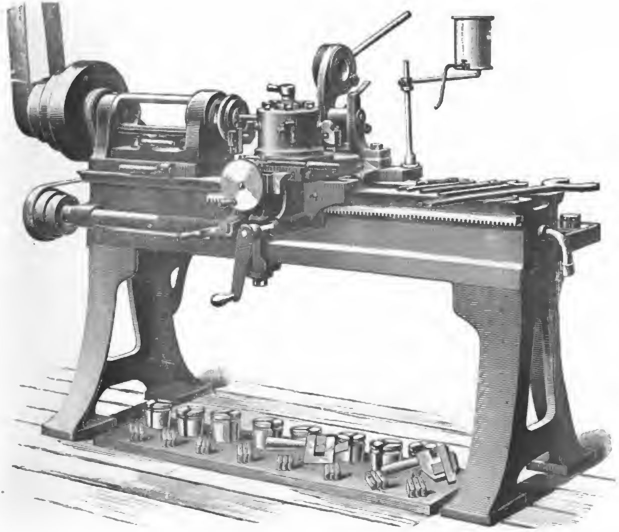
A propeller blade can be made of No. 2 brass, at least one-third thinner than cast iron, and would be correspondingly lighter. The high elastic limit, surpassing that of alloys used hitherto for this purpose, would greatly lessen the chance of injury to the blades, in the event of contact with wreckage, whales, &c., at present a frequent source of danger and delay.

In these days of fast steaming the weakening of blades by pitting and corrosion would be reduced to a minimum, if made of aluminium brass. This is but one of the very many instances which will readily present themselves to the minds of readers who will compare the physical data given above with that obtained from other alloys and metals, which it will doubtless supersede as its qualities become more known. Not only is aluminium valuable in its alloys with copper, but it is of service in iron and steel working, giving sound castings and increasing the tensile strength. The alloys with zinc, nickel, tin, and manganese, are of great interest, but space will not permit of anything beyond a brief note on a few of the properties and applications of a metal which may be truly described as one of the most valuable gifts of science to craftsman and engineer in this age of industry

STUD CHASING LATHE.

By the Britannia Company, Colchester.

THE illustration we here give represents this company's improved hollow and open-sided Spindle Lathe with Capstan Rest, for quickly and cheaply producing screwed studs, joint pins, and small fittings of all kinds, usually done in a lathe. By means of this tool these can be made uniformly and quicker. It will turn, point, and chase studs at one operation by means of the capstan rest. The headstock is constructed of two parts, accurately fitted to slide one over the other, to adjust for taking up wear of spindle, the latter being made of steel, with hardened conical neck, with hole through its length to take long rods, and its sides open to enable headed bolts to be inserted for screwing, and the nose fitted with a coned chuck and gripping dies for nine sizes of tools—¼ in. to 1 in. diameter. The saddle is arranged with transverse slide, carrying a capstan tool holder, fitted with five tools, adapted for sliding, rounding points, surfacing, parting, &c., and on it is mounted the screwing arrangement with die box and adjustable dies for screwing ¼ in., 5/16 in., ⅜ in., ½ in., ⅝ in., ¾ in., ⅞ in., and 1 in., and is hinged to throw back out of the way when not screwing. The saddle is also fitted with quick traverse by rack and pinion, as well as self-acting traverse by fine thread leading screw with conveniently disengaging nut. The bed is of trough section to catch the soap and water, and constructed to conveniently draw it off.

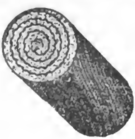


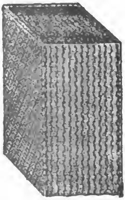
IMPROVED LATHE FOR MARINE WORK.

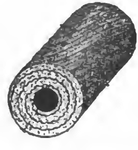
MESSRS. CUNLIFFE & CROOM, of Broughton Iron Works, Manchester, are at present constructing a specially designed large lathe for turning marine crank shafts, propeller shafts, propellers and large rope pullies, of which a description will be of interest to our readers. The machine is, in its essential features, an exceptionally powerful self-acting sliding, surfacing, and screw-cutting break lathe. The bed is of sufficient length to admit articles 26 ft. long between centres when the gap is open the full extent, 11 ft. from the face-plate; the bed is arranged to slide to and from the face-plate on the front and back foundation-plates, having grooves for the feet of the bed to slide in. The fast headstock is 36 in. high to the centres above the face of the sliding bed, and 4 ft. 7 in. above the face of the foundation-plate. There is a treble-power gearing, with a steel spindle running in parallel bearings with a face-plate 8 ft. in diameter. The loose headstock is mounted on a saddle, with a lateral adjustment by a screw, and set-pin for the true adjustment of the spindle. The machine is provided with a very strong massive duplex carriage, fitted with two rests, the front one of the ordinary form, and the back one made specially narrow for turning down the sides of sweeps and the pin on crank shafts. An additional front bed is provided moving to and from the face plates on the foundation-plates. This bed is of sufficient length, and the special rest with which it is provided is of sufficient height to turn articles when fixed between the centres of the lathe, and the ordinary bed is drawn back to the full extent, up to 9 ft. diameter and 11 ft. long. The face-plate is arranged to run over a pit 3 ft. wide, to admit articles 17 ft. diameter, and the front bed and rest can be drawn back to turn articles this size. The shaft to couple up to the guide screw is arranged to easily disengage, and can be drawn back when the pit is in use.

NEW ENGINE PACKING.

THE accompanying illustrations show the special features of a new engine packing, particularly suitable for marine purposes, which has just been introduced by Messrs. David Moseley & Sons, of Manchester, and which they have termed the "Duriflex" packing. The main object aimed at in this new packing has been to combine the durability of a metallic packing with the flexibility of a fibrous packing, and the results secured after the most thorough tests and trials that have been made with the "Duriflex" packing in the cylinders of marine engines certainly are ample proof that the manufacturers have been successful in attaining the above combination. The illustrations show pretty clearly the special character of the packing, but it may be added that it is constructed in a peculiar manner from wire gauze and a fibrous material such as asbestos or cotton, the nature of these two materials giving to it the qualities of durability and flexibility in a high degree. Any form can be given to the packing that may be required for special purposes, and it can be manufactured with or without india-rubber cores, but the ordinary forms represented in the illustrations are generally used. The chief feature of the packing is the special manner in which the wire-gauze—which in the illustration is indicated by the thicker black lines—is prepared before insertion in the packing by cutting or corrugating it diagonally, and by placing it between the layers of the fibrous material with the cuts or corrugations diagonally arranged. By this special method of manufacture the rigidity of the wire gauze is entirely removed, and the packing possesses as great a flexibility as similar packing made entirely of fibrous materials. As we have already stated, this packing is specially applicable for marine work, where long runs are a necessity, and trials on steamers' engines have given most satisfactory results. Mr. G. W. Matthews, the chief engineer of the s.s. *Trevorian*, writing on January 10th, states that the triple packing which had been supplied by Messrs. Moseley had given every satisfaction. The high-pressure valve spindle of the above steamship was packed with it on July 10th, 1889, and had only just been repacked after having run a distance of 20,000 miles. The piston rod gland, which was packed at the same time, was still in, and he could, therefore, with confidence recommend the "Duriflex" as a good and reliable packing for high-pressure engines. In the opinion of other engineers the packing has also shown itself superior to other engine packings on board the *Trelawney*, the *Trewavas*, and other steamers in successive runs to the Black Sea and other voyages, and we are informed it is about to be used in the well-known liners the *City of Paris* and the *City of New York*. One feature of this packing is that after long wear, whilst it fully preserves its properties as a cushion, the outside surface becomes perfectly bright, and it gives also a bright surface to the cylinders, and prevents any uneven wear.







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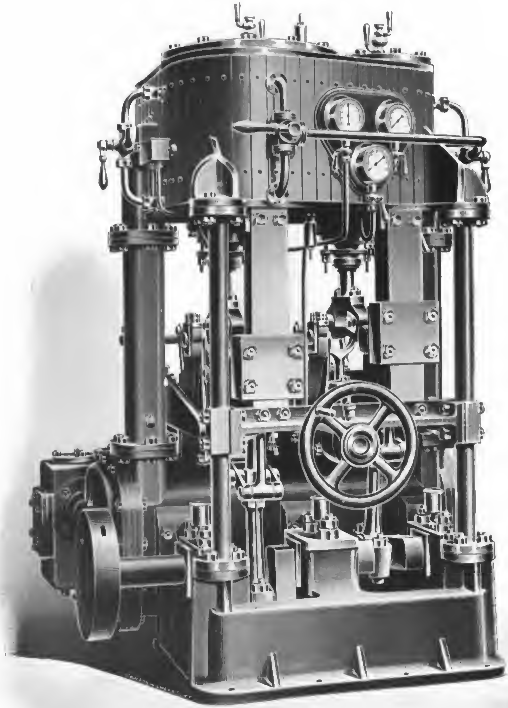

IMPROVED MARINE ENGINES, Constr
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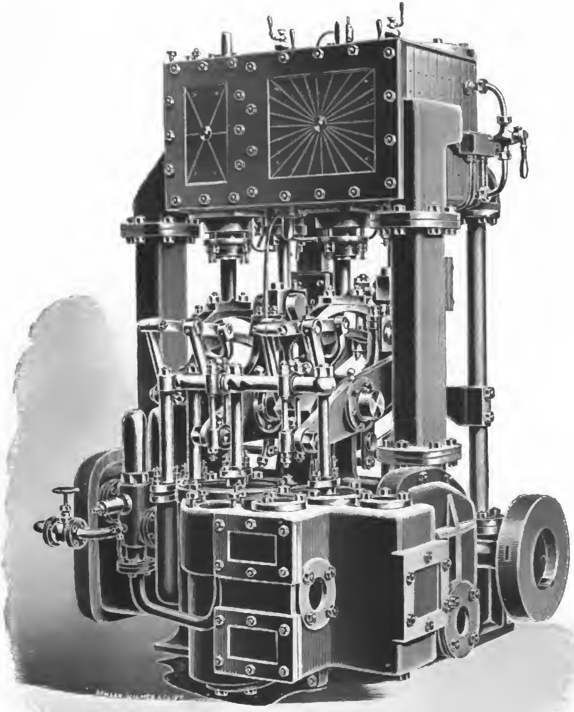

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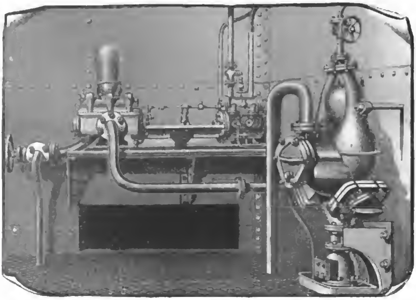
THE PULSOMETER ENGINEERING COMPANY, LIMITED.

THE various uses to which the pulsometers turned out of this company's works at Nine Elms, London, are put, are so numerous that they may fairly be termed legion. When applied on board ship they are found to be invaluable for pumping out water-ballast tanks; pumping out bilges; circulating water through condensers; washing decks; extinguishing fires; filling the main boiler after cleaning out; pumping water for sanitary purposes; and circulating water through fresh water condensers. They have also proved very handy in many instances for salvage purposes. They can be slung up to any portion of the rigging, or down one of the hatches, steam being conveyed through flexible hose, in case of need, from the boiler of a tug some distance off. The pump may be put to work in a surprisingly short space of time. The illustration we give above represents a pulsometer for circulating sea-water through the winch condenser and evaporator lately fitted to a large American liner, as well as one of the company's Deane pumps for drawing from the tank containing the fresh water with which the winch boiler is fed. All the pumps for main boiler and other feeds are specially constructed to suit the heavy-pressures now carried, and can be thoroughly relied on. All the company's specialities for steamers are in extensive use in the Mercantile Marine, and the very numerous testimonials they have from those who have used, and are using them, proves that they answer their intended purposes well, and amply perform all they claim to do. The Pulsometers, besides being cheap, are noiseless, cost little to repair, and require neither oil, tallow, nor packing, and freely pass chips and pieces of coal.



IMPROVED MARINE ENGINE.

Constructed by Messrs. Alexander Shanks, Sons, and Co., Ltd., Dens Iron Works, Arbroath, N.B. Fitted with Morton's Patent Reversing "Valve Gear."

THE engine illustrated by our engraving has been designed with a view to compress the space occupied by compound or triple-expansion engines when fitted into vessels of small dimensions.

Those under notice are compound, surface-condensing engines, having cylinder 8 in. by 16 in., and 9 in. stroke.

The valves and valve-gear are placed at the back of the engine over the condenser and on the cross centre line of the cylinders.

The steam from the boiler enters the high-pressure valve chest through the top of the forward cast-iron column, and is exhausted down to the condenser through the after cast-iron column, thus avoiding the long exhaust steam passage from the low pressure valve casing round the side of the cylinder, when the valves are at the front.

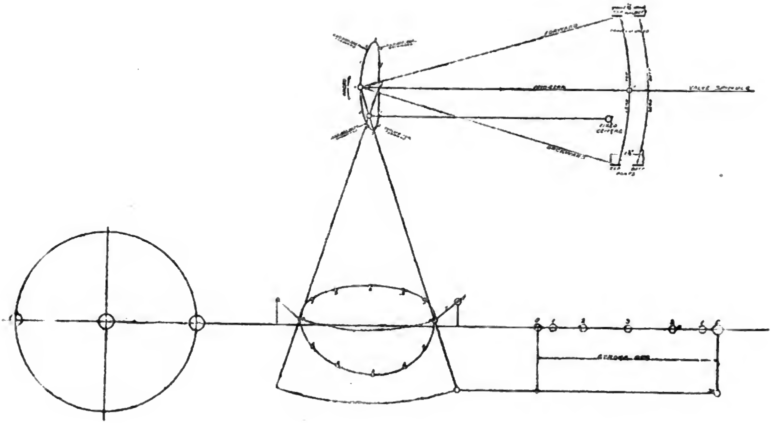
The reversing shaft is carried on the top of the condenser, and actuated from the front, or starting side by the hand wheel and rod, carried in a bearing cast on the guide bar bearer, which is carried between the front (malleable iron) columns; this bearer is provided with oil boxes, cast on to collect the drip from the crosshead slides.

The air, feed, and bilge pumps are driven by one set of levers threaded upon the reversing shaft, and provided with adjustable brass bushes.

The "valve-gear" is of the radial class, Morton's system, a full description of which appeared in the Marine Engineer, No. 124, Vol. xi., pp. 155, 156 and 157.

This system of reversing "valve-gear" lends itself to the economising of space and weight, and has advantages possessed by no others of its class. The special features of this system have been fully dealt with in a paper read by Mr. Robert Bruce at the Institute of Marine Engineers in September last, but it may be stated here that these consist essentially in the means adopted by the inventor whereby the valve is made to move in unison with the *piston* in either direction of rotation of the engine.

The outline diagram published herewith shows the arrangement of the gear. P is a radiating crank centred in a projection P^1 on the connecting-rod; A is the pin of the crank P. The crank gets its motion from the piston through the link B, and overhung end of the "lead" or "valve" lever, F, which motion is so controlled that the angularity of the connecting rod and of the valve lever is compensated for by one and the same movement, and a uniform motion imparted to the fulcrum centre of the valve lever which is carried on the link vibrating from the "fixed centre." The direction of rotation of the engine or degree of expansion is controlled by the adjustable link H, which is shown in "mid. position."



Full particulars of the "Valve-Gear" may be obtained from Mr. Robert Bruce, Engineer for the proprietors of Morton's "Valve-Gear" patents, at 70, Bishopsgate Street, London, E.C.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from March 25th to April 21st.

Anderson, Wm. J., engineer to the *Vulcan*, to date April 21st.

Armstrong, Jas. engineer to the *Thunderer*, to date April 21st.

Batchelor, H. R., assistant engineer to the *Magicienne*, to da April 15th.

Bearblock, Chas. W. J., assistant engineer to the *Trafalgar*, to date April 2nd.

Broadbent, Chas., assistant engineer to the *Sheldrake*, to date March 28th.

Carnt, A. J., engineer to the *Trafalgar*, to date April 2nd.

Coad, H. J., engineer to the *Magicienne*, to date April 15th.

Drake, Percy G., (probationary) assistant engineer to the *Trafalgar*, to date April 2nd.

Ford, Francis, staff engineer to the *Prince Albert*, to date April 7th.

Garwood, H. T., assistant engineer to the *Magicienne*, to date April 15th.

Green, Leopold M., fleet engineer to the *Audacious*, to date April 1st.

Grant, W. H., chief engineer to the *Pelican*, to date March 23rd.

Green, Richard W., engineer to the *Trafalgar*, to date April 2nd.

Guyer, Thos. S., assistant engineer to the *Audacious*, to date April 1st.

Harding, T. J., engineer to the *Sanspareil*, to date March 28th.

Harding, Robert, chief engineer to the *Cyclops*, to date March 26th.

Hardwick, W. W., engineer to the *Blonde*, to date March 28th

Hearson, Hugh R., engineer to the *Mersey*, to date March 28th.

Hudson, W., engineer to the *Assistance*, to date March 28th.

Jenkins, John H., assistant engineer to the *Ringarooma* (late *Psyche)*, to date April 21st.

Leader, Herbert J., assistant engineer to the *Audacious*, to date April 1st.

Leighton, Jas., staff engineer to the *Magicienne*, to date April 15th.

Little, Edwin, chief engineer to the *Agincourt*, to date March 28th.

Lonnon, William, chief engineer to the *Mohawk*, to date April 21st.

O'Neill, John, assistant engineer to the *Conqueror*, to date March 28th.

Page, Frederick J., assistant engineer to the *Orontes*, to date March 28th.

Peal, Henry C. W., engineer to the *Inflexible*, to date April 1st.

Pearce, R. H. (probationary), assistant engineer to the *Himalaya*, to date April 15th.

Pill, J. H, engineer to the *Pembroke*, additional, to date March 21st.

Raper, R. St. J., engineer to the *Asia*, additional, to date March 28th.

Richardson, Jno., engineer to the *Defiance*, additional, to date April 1st.

Rigler, Geo., staff engineer to the *Trafalgar*, to date April 2nd.

Stearn, Walter T., assistant engineer to the *Salamander*, to date March 28th.

Stevenson, John L., staff engineer to the *Rupert*, to date April 7th.

Steward, C. H., chief engineer to the *Thrush*, to date April 19th.

Watkins, Benjamin J., engineer to the *Orontes*, to date April 21st.

Weeks, Edward J., assistant engineer to the *Trafalgar*, to date April 2nd.

HOAR & BROWN'S HARDWOOD MARKET REPORT, April 24th, 1890.

TEAK.—Business has been fairly satisfactory this month, the deliveries to the 22nd inst. amounting to 551 loads. Stocks have been further increased by the arrival of three cargoes, one from Moulmein and two from Bangkok.

There is very little enquiry for future business, and the tone of the market is rather depressed, principally in consequence of holders endeavouring to force sales of the inferior wood, which constitutes so large a portion of the stock.

First-class squares still command fair prices.

MAHOGANY.—An active market has prevailed during the past month, and prices remain firm, although the arrivals, both from Honduras and Mexico have been heavy. This, coupled with the reports of further shipments close at hand, must certainly weaken prices, especially for small and inferior classes, unless the existing speculative demand continues.

CEDAR.—A slight improvement has taken place in the tone of this market, prices having risen a point, but the consumption is still very small, and should any large consignments arrive, values will again decline.

AMERICAN WALNUT.—First quality logs and planks find a ready market, but inferior lumber is still very slow of sale. The stock of the latter class being unusually large, the prices are not likely to be maintained.

AMERICAN OAK.—Business is quiet, and prices remain fairly firm.

GREENHEART.—Enquiries are very small, and the market is now almost bare of stock.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE past four months' doings in the shipbuilding and engineering works of the Clyde have resulted in a sweeping reduction of the work on hand, as at the end of last year. In consequence, however, of the almost complete cessation of fresh orders since that period, this reduction is also a measure of the diminished amount of work on hand at the present time. During the four months as many as 82 vessels, with an aggregate tonnage of about 128,000, were first put into the water as against 56 vessels, of about 80,500 tons, in the first four months of last year. The production of the past four months, indeed, has never been equalled in the history of the industry before, the nearest approach being the first four months of 1883, when the output aggregated 117,420 tons. Comparison with other years, however, will be best made from the following table, which gives the output for the first four months of this and eleven previous years:—

1890	128,000	1884	88,400
1889	80,470	1883	117,420
1888	61,200	1882	95,600
1887	53,800	1881	91,800
1886	52,200	1880	70,000
1885	57,200	1879	61,600

At the beginning of the year there were, in round figures, 300,000 tons of new work in progress in Clyde yards. This figure has been diminished by the four months' operations to about 185,000 tons, including the new work ordered during the period. This new work only amounts to some 15,000 tons, whereas in the first four months of last year there were close on 81,000 tons ordered. To account for this very marked cessation of fresh contracts one must consider the great amount of Government work on hand, and the prolonged activity that kind of work implies, and the consequent influence that and other classes of contracts have had on the prices of material and labour. Twelve months ago steel ship plates cost £7 12s. 6d., while at present the price is £9 10s.; or an advance of £1 17s. 6d. Labour also is from 12 to 18 per cent. in advance of what it was at that time. The tendency of the freight markets is not at all encouraging and this fact, together with the large number of traders recently built and still on the stocks, will effectually prevent any very marked increase in new business—at least, until freights are better and steadier, and a decrease takes place in the present prohibitive prices for labour and constructive material.

During April alone twenty-five vessels of approaching 47,500 gross tons have been ushered into their native element, while to compensate for this, scarcely more than 5,000 tons of fresh work have been booked. Many of the yards are, therefore, assuming a barren sort of aspect, and a corresponding diminution in the stir and bustle which have so long prevailed. Contributing to the 47,800 tons of output for the month were some pretty large vessels, one, the *Clyde*, for the Royal Mail Steam Packet Co., in itself totalling 5,650 tons, and five others being above 3,000 tons each.

Amongst the very few fresh orders placed since last month's report, the only one of importance is that received by Messrs. Lobnitz & Co., Renfrew, for three large dredgers, placed by a London firm. An order to build a 350-ton steel steam yacht has been placed with Messrs. Ramage & Ferguson, Leith, by Mr. Harry Taylor, late owner of the well-known schooners, *Bluebell* and *Hildegarde*. The new vessel, which will be designed by the builders, is to be 22 ft. beam, with greater depth than usual, and is to be propelled by triple-expansion engines, having cylinders 15½ in., 25 in., and 40 in. diameter, by 27 in. stroke, all adapted for a very high rate of speed. The owner's accommodation is chiefly forward, and will be fitted up in the builders' best style, while all the latest improvements will be introduced. Besides this steam yacht, Messrs. Ramage & Ferguson are laying down one of 600 tons, and are at present planking up a large 850-ton auxiliary now on the stocks.

Two novel and ingenious styles of derricks for raising heavy weights have recently been erected in the shipyard of Messrs. R. Napier & Sons, Govan. This style of crane, which is the contrivance of Mr. J. Hamilton, one of the partners, is worked by hydraulic power. The derricks have been constructed by the firm, and put into position at the first-class cruiser presently under construction for the British Admiralty, one being placed at the forward part of the vessel and the other aft. They appeared like a couple of masts, but square instead of round, with two sets of hydraulic block and tackle gear at the top. A weight of about 15 tons can with these be raised from the ground and fixed into any position in the ship. The vessel in which they are placed is as yet only in the skeleton stage.

One of the readiest firms to avail themselves of modern improvements is that of Messrs. Denny & Co., engineers, of Dumbarton. This firm have now the tools in their pattern shop driven by a 20 H.P. electromotor. The dynamo is placed in the machine shop, and driven from the ordinary shafting. From the generator to the motor in the pattern shop the current is conveyed through two cables about ⅝ in. in diameter. If this had not been done, a separate small engine and steam piping of great length would have been required. In the boiler shop of the same firm there is a still more interesting example of the application of electricity as a motive power. This is Rowan's patent electric boring machine, for boring the rivet holes through boiler shells *in situ*, and which not only has a small motor to drive the drill, but holds itself up against the plate by means of a pair of powerful electro-magnets. Messrs. Denny are about to put electromotors to other uses in their yard, amongst the earliest of which will be the driving of all the sewing machines in their upholstering department, at present driven by the feet of the female operators.

It is not generally known, and is perhaps worthy of note that the art of shipbuilding in Dumbarton, the town which has produced and nurtured such masters of the art as the Napiers and Dennys, and whose fame as a shipbuilding port is now known over the whole navigable globe, dated as far back as the year 1494-95. At that time the building of a naval ship was regarded as an event so important that moneyed Scotsmen made offerings of masts, sails, oars, &c., and the cost of every pot of pitch and cwt. of nails was set down in the national accounts. James IV. had a man-of-war built here in the years named. His master-of-works, Sir George Galbreth, was entrusted with the building of a large row-barge and two boats, and with the repairs of the ship *Christopher*. The timber was taken chiefly from the banks of Loch Lomond, and floated down the river Leven to Dumbarton. The iron-work was partly fashioned on the spot, and partly brought from Edinburgh. The work occupied twenty-eight weeks, and cost £517 9s. 11d.

Quite a large fleet of fast paddle steamers for both river and channel service has formed part of the new work with which the Clydeside shipyards and engine shops have recently been engaged. Three handsome swift river-boats are being added to the fleet of the Caledonian Steam Packet Co. for service on various coast routes, *viâ* the company's splendid new station and pier at Gouroch. All these boats have been built under the able superintendence of Captain Williamson, the company's marine superintendent, and, for long, the highly popular and respected commander of the river steamer *Ivanhoe*. To augment this favourite steamer's service on the Arran route, Captain Williamson is adding a swift and handsome vessel from the stocks of Messrs. William Denny & Bros., Dumbarton. The new vessel will run in connection with the train service to Ardrossan, and, without doubt, the accelerated service she will inaugurate will still more popularise this—the shortest—route to Arran. Messrs. Denny & Bros., in addition to the above vessel, have on the stocks a new paddle steamer of high speed for Thames service, to run between London and Clacton-on-Sea, and they have just handed over the paddle steamer *Princess Victoria* to her owners, the Portpatrick and Wigtonshire Railways Joint Committee. This vessel, which is 280 ft. long by 35 ft. 6 in. broad and 22 ft. deep, has been built for the Channel service between Larne and Stranraer, and it is intented that she should perform the journey in less than two hours. From exhaustive trials made by the builders and representatives of the owners, before being handed over, the *Princess* has shown herself capable of steaming 20 knots, or 23 miles per hour. As the mean of two double runs over the measured mile at Skelmorlie, her ordinary speed was found to be 19·65 knots, a noteworthy result, considering her limited length and full width. The speed guaranteed was only 19 knots.

The *Normania*, the new Hamburg American Co.'s palatial steamship, built by the Fairfield Co., has just left the graving dock, and is about to proceed down the river for a series of trial runs, previous to her being handed over. This immense vessel has been built in less than twelve months, a feat unparalleled in shipbuilding annals.

At the sixth meeting of the session of the graduate section of the Institution of Engineers and Shipbuilders in Scotland, held early in April, the discussion on Mr. J. Wier's paper on "The Drawing Office Practice as applied to Marine Engineering" was concluded, and a vote of thanks awarded to Mr. Weir. A paper on "Regulating the Speed of Steam-engines" was read by Mr. John A. Rudd, in which he described the various forms of conical governors, also Wilby's regulator. Mr. Rudd was also awarded the thanks of the section.

The *State of California*, the new vessel presently under construction for the State Line, in the yard of Messrs Alex. Stephen & Sons, Linthouse, will be in frame in the course of a few weeks. In general design this vessel will resemble the s.s. *State of Nebraska*, a most successful vessel, and one that has always been a great favourite with travellers between this country and the United States. The *State of California*, however, is rather larger in dimensions, and will carry considerably more cargo. In designing this vessel the company did not contemplate entering the lists in competition with those very costly and luxurious vessels recently built for the conveyance of passengers at a high rate of speed. From her large earning power as a freight-carrier they will be able to continue to give the most comfortable accommodation for all classes of passengers at very moderate fares, for which the State Line is so well known. As the trade between Glasgow and the United States is constantly developing it is confidently predicted that the new steamer will be found not only a safe and profitable investment to all those interested in her, but will also prove a source of credit and profit to the old established line under whose management and flag she is to be sailed.

Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, are justly entitled to feel elated at the doings of their production, the dredger *Preston*, and at present working in the Ribble, two or three miles below the Bull Nose. This vessel recently lifted 20,000 tons of clay and gravel in 46 hours, a most extraordinary record in dredging annals. Such a feat has, so far as can be learned, never before been achieved by any dredger afloat; and it speaks highly of the capability of the huge machine and the thorough efficiency of its management.

At the public graduation ceremony of the Glasgow University on 25th April, the honorary degree of Doctor of Laws (LL.D.) was conferred upon, amongst other noted "captains of industry," Mr. Peter Denny, the well-known shipbuilder and engineer, of Dumbarton. For this honour no more worthy representative of all that is advanced and progressive in the great staple industry of the Clyde could have been selected than Dr. Denny.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOLS, TEES, &c.

THE TYNE.

Shipbuilding.—Thanks to the Government contracts that were given out some months ago, and to the fact that before the price of tonnage had risen to its present height, a great many orders for cargo and passenger vessels had been booked, the principal yards on the Tyne still show an appearance of briskness, but in a few cases signs of coming slackness are apparent, and there is no doubt whatever that some of the builders are now engaged upon their last orders. The workmen have a theory that high prices, brought about by dearer labour and material, have no effect in stopping the influx of orders, as, according to their favourite dictum, the ships must be built if there is a need for them, no matter how high the cost. This, of course, is a very palpable error, as enhancement of value must always have a tendency to restrict consumption and purchase, no matter what the article of commerce may be that is affected. If the men could be led to form a sounder judgment upon this question, which is really one of vital consequence to themselves, they would probably be less persistent in their demands for wages advances, and a continuance of satisfactory trade and steady employment would be more assured. It has not transpired that any new orders have been booked during the month, but there have been some heavy repair contracts arranged for, and these will keep the proprietors of graving docks busy for some time. It may here be stated that the Blyth Shipbuilding Co. are now just completing their large new dock, and will very shortly be in a position to undertake the most extensive repairs to both the hulls and machinery of vessels. Dredging operations are now being proceeded with to ensure a sufficient depth of water to admit of large vessels passing in and out of the dock. There are just now in progress in the various yards of the Tyne (not including the smaller concerns where tug and ferry steamers are built) a total of 60 vessels having an approximate aggregate tonnage of about 140,000 tons. In addition to these there are about a score of vessels fitting out, and at least as many more in the initiatory stages of frame-turning or designing. Thus the total number of vessels which may be said to be in hand at this moment reaches nearly 100, and it will be a safe estimate to place the aggregate tonnage of the whole at something like 250,000 tons. Fifteen of the vessels are war-ships, and they are distributed among the following firms:—Messrs. Armstrong, Mitchell & Co., the Palmer's Shipbuilding & Iron Co., Messrs. Hawthorn, Leslie & Co., and Messrs. R. Stephenson & Co. The two last named firms have only one each of the war-ships on their stocks (a sloop and a cruiser), the remainder being in the hands of the first named. Among the remaining 45 vessels are eight or ten passenger ships, the firms who have succeeded in obtaining these contracts being—Messrs. Richardson & Co., Messrs. Hawthorn, Leslie & Co., and Messrs. C. S. Swan & Hunter. The whole of the other vessels are cargo boats, but many of them are of special design, being intended for employment in special trades, such as the carrying of petroleum in bulk, the dead meat trade, &c. Out of the eighty and odd building berths on the river nearly one fourth are now vacant, and should the present lack of enquiries continue, there is no doubt that the number will be considerably increased a few months hence. Two of the berths at present vacant at the Jarrow yard are being prepared for the building of the line-of-battleships, ordered from the Palmer's Co. by the Admiralty. The construction of the three cruisers which the same company are building at their Howdon yard, is being pushed on with all possible dispatch, and it is understood that during the summer months most of the hands employed in connection with these vessels will be required to work overtime. The shipbuilding yard at Bilbao, in which this great firm is interested is almost as busy as their establishments at Jarrow and Howdon, and taking all their undertakings into account, it will readily be conceded that so far as the shipbuilding trade is concerned, they hold the foremost position.

Engineering.—Under this head there was given in last month's issue a short account of the dispute respecting the "12 o'clock Saturday" question, which was then causing a general stoppage of work in the district. All that now need be said respecting the dispute is that through the instrumentality of the Mayor of Newcastle it was settled amicably, and that after more than a week's idleness, work was fully resumed. The basis of the settlement is, that the stopping time on Saturday's will from May 10th be at noon, the working hours to be 53 per week instead of 54 as at present. In return for this concession, the operatives have promised to take fewer holidays, and in one or two other particulars to adopt measures which it is understood will, to some extent, reimburse the employers for the loss caused by the change. In marine engineering, great briskness still prevails, in spite of the fact that no new contracts are being placed. At the time of writing, the Wallsend Slipway Co. are engining a large petroleum steamer, which was recently launched from the Low Walker yard of Messrs. Armstrong, Mitchell & Co., and at the Palmer's Co.'s sheerlegs there are several vessels having their machinery fitted, or waiting "turns." The North-Eastern Engineering Co. have booked an order for a powerful set of triple-engines, required for a passenger vessel about to be built on the Wear, and the work has to be executed at the Wallsend establishment of the firm. This is probably the most important order for marine engines that has been placed on the Tyne this year. In locomotive engineering there is a fair amount of work being done, the North-Eastern Railway Co.'s shops at Gateshead being particularly busy. At this establishment there are a number of engines of a specially powerful type in course of construction, one of which is to be shown at the Edinburgh Exhibition. In the engineering shops which are not specially devoted to marine or locomotive engine-building business continues tolerably active. Among such establishments, Messrs. John Abbot & Co., of Gateshead, hold a foremost place, and all departments of that factory are just now well supplied with orders. Much of the work in hand consists of hydraulic machinery, in which branch of engineering the firm have achieved a deservedly high reputation. The works of Messrs. John Spencer & Sons, at Newburn, show undiminished briskness, and the erection of the new steel-rolling mills is being energetically proceeded with. The firm's forge works at Ouseburn are kept going night and day. In the other forges business continues brisk, and at most of the foundries there is still a pressure of work. Manufacturers of steering gears, steam winches, windlasses, engine-room telegraphs, and other steamship accessories, are still having plenty of work, but new orders are not coming in to replace those completed. There continues to be an active demand for ships' outfits of chains and anchors, and manufacturers of the same are very fully employed. Messrs. Emerson, Walker & Thompson Brothers, Limited, are plentifully supplied with orders for their various specialities, and notwithstanding the enlargements which have been made in their works during the last three years, they still find great difficulty in meeting the demands of customers, and are now contemplating the carrying out of further extensions.

Electric Lighting.—Messrs. E. Scott & Co., of the Close Works, Newcastle, are just about to send away for shipment to the Argentine Republic a powerful electric lighting plant for an industrial establishment in that country. The plant is of the type known as the "Tyne" vertical engine and dynamo combined, which is now being extensively ordered for steamship installations. Messrs. J. H. Holmes & Co. have commenced operations in the new wing just added to their electric lighting works, and great activity now exists throughout the whole establishment. The firm have a large number of steamship installations in hand.

THE WEAR.

Shipbuilding.—Though there is still a great quantity of work in the Wear shipyards, the fact that the beginning of a slackness is already felt is made clear by the circumstance that at several establishments discharges of hands have recently taken place, and the unemployed men are beginning to leave the port in search of work elsewhere. The number of vessels at present on the stocks of the various yards is 42, and it may be estimated that the aggregate tonnage of these will pretty nearly approach 100,000 tons. There are no war-ships building on the Wear, but several firms have long since established their ability to deal successfully with the higher class of merchant vessels, and a few have now in progress at their yards passenger vessels of a large and expensive class. Wearside builders have also achieved distinction in building vessels for special trades and purposes, in which exceptionally good sea-going qualities are desirable; and some good specimens of these types have recently been turned out. Since the introduction of mild steel as a shipbuilding material, some very large sailing vessels built of that commodity have also been built on the Wear, and there are now in course of construction two such vessels, which are likely to greatly enhance the reputation of the port for that class of work. The graving docks have been pretty constantly occupied with vessels undergoing repairs since the opening of the year, and this work has been an important addition to the local sources of employment. Among the vessels now in hand is the oil steamer *Wild Flower*, which although a new and strongly built ship, has had to be put in dock to undergo more or less extensive repairs, for the second time within three months. The vessel has, as a matter of fact, been somewhat unfortunate, damage by collision, and other accidents having been the cause of her temporary laying up on both occasions. Messrs. R. Thompson & Sons, who are carrying out the repairs to this vessel, have some other extensive repair contracts to proceed with.

Engineering.—At the Palmer's Hill Engine Works several vessels, launched from the yards of local builders, and mostly of large size, have been fitted with their machinery during the month, and there are now in the shops some half dozen sets of engines in various stages of progress. A considerable number of crankshafts (Dickinson's patent) have also been supplied to old vessels lately, and there are now a good many on order. Messrs. Doxford have some exceptionally powerful engines in progress just now, and the firm are employing rather more than the ordinary number of hands. At the Southwick Engine Works and also at the North-Eastern Engine Works, South Dock, business is very active, and a resort to night-work continues to be necessary. At the Scotia Engine Works the pressure of work is still very heavy. Messrs John Lynn & Co., of the St. Luke's Engine Works, Pallion, have a great many orders for steam winches, steering gears, &c., and although no new orders are now coming in, there is no liklihood of any slackness being experienced at this establishment during the next nine months. Other firms engaged in the same lines are also well off for orders. There is still a good deal of pressure on the resources of iron-founders, and all the establishments in this district are as busy as possible. Brass-founders and copper-smiths are similarly placed, and are generally working overtime. In the forges there is still a good deal doing, but there are not wanting indications that a lessening of the present briskness may soon be felt. Steel works, iron works, and rivet works continue to be kept fully going, and at the local chain and anchor works a satisfactory business is being done.

The Hartlepools.—The operations of Messrs. W. Gray & Co. during the current year bid fair to be of as extensive a character as those of last year, the firm, up to the present, having launched eight large vessels, and having now three or four others almost ready for leaving the stocks. Messrs. Withey & Co. have also turned off a considerable amount of tonnage during the four months that have elapsed, and Messrs. Irvine & Co. have made a respectable contribution to the output of the port in the time stated. The last named firm having recently extended their premises, have now three vessels on the stocks, and are likely to greatly exceed their past records of production in the current year. At the Central Marine engine Works business continues active, and at Messrs. Richardson & Son's Works the briskness that has distinguished the establishment for the past couple of years, is still maintained. Owing, however, to the persistent applications for wages advances that are being put forward by certain sections of the workmen, the firm have recently found it necessary to decline negotiating for contracts, and if they adhere to this line of policy, slackness must necessarily be felt at the works ere long. Since March 22nd the firm have engined at the sheerlegs the following vessels :—The s.s. *Storm King*, for Messrs. W. Ross & Co., of London, having cylinders 28 in., 44 in., 72 in. by 48 in. stroke, with two large double-ended boilers of 160 lbs. working pressure. The s.s. *Ruskin*, for Messrs. Arthur Holland & Co., of London, having cylinders 22 in., 35 in., 59 in., by 39 in. stroke, and two large single-ended boilers of 160 lbs. working pressure. The s.s. *Monrovia*, for Messrs. F. Dempster & Co., of Liverpool, having cylinders 22 in., 35 in., 59 in. by 39 in. stroke, and two large boilers of 160 lbs. pressure. In the same period the following ships have had highly satisfactory trial trips:—the s.s. *Norse King*, for Messrs. W. Ross & Co., on the 27th March; the s.s. *Paranagua*, for Cie Chargeus Reunis, on 19th April. We understand that the firm are just now busily engaged with the manufacture of evaporators, particulars of which we hope to be able to give in the MARINE ENGINEER for June.

Stockton.—There is still a good show of work at the Stockton shipbuilding yards, and the demand for labour continues to pretty well absorb the supply. The Stockton Forge Co. have a good many important orders in hand, and at the works of Messrs. Wrightson & Head considerable activity is to be noticed. Messrs. Blair & Co. are still quite busy, and in addition to the large number of marine engine contracts they have in hand, are now engaged in putting complete electric lighting installations in two steamships belonging to the Greenock Steamship Co., namely the s.s. *Gulf of Papua* and the s.s. *Gulf of Lyons*. The latter vessel is in course of construction by Messrs. Caird & Co., of Greenock, and it will be the twelfth that Messrs. Blair & Co. have fitted with the electric light for the Greenock Co. Since March 19th the following vessels, engined by Messrs. Blair & Co., have had successful trial trips :—The s.s. *Windsor*, built by Messrs. W. Gray & Co., of West Hartlepool, for Messrs. Watts, Ward & Co., London, having engines of 190 N.H.P., with cylinders 23 in., 37½ in. and 61½ in. by 39 in. stroke. The s.s. *Amie*, built by Messrs. Ed. Withey & Co., of West Hartlepool, for Messrs. Burdock & Cook, of London, having engines of 155 N.H.P., with engines 21¼ in., 35 in., and 57 in., by 36 in. stroke. The s.s. *Fairmead*, built and owned by Messrs. Thos. Turnbull & Son, of Whitby, having engines of 175 N.H.P., cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The s.s. *Arala*, built by Messrs. Ropner & Son, of Stockton, for Jas. M. Wood, Esq., of Liverpool, having engines of 390 N.H.P., with cylinders 28 in., 46 in., and 75 in. by 54 in. stroke. The engines of the latter vessel are constructed to work up to 170 lbs. pressure of steam, and those of the other vessels mentioned to 160 lbs. pressure. Boiler works and establishments that are devoted to other branches of engineering besides marine work, are generally kept briskly going, while steel rolling mills continue to be, if anything, over supplied with orders.

Middlesbro'.—Messrs. Raylton, Dixon & Co. have during the month put two good-sized vessels off the stocks, and the prospect of work which was beginning to look somewhat doubtful has been much improved by the firm having secured a contract to build three steamers of large tonnage. The firm are at present fitting out no less than seven steamers, and the building berths in both their yards are fully occupied. In addition to this work, the firm are repairing on their slipway a steamer which has recently been in collision in the Tees. Messrs. Craggs & Son have just launched a steel steamer of about 2,000 tons carrying capacity, which has been built to the order of Messrs. Ed. Harris & Co., and the vessel is now having her engines fitted by Messrs. Westgarth, English & Co. Messrs. Craggs & Son are now plating a large vessel at their Middlesbro' yard, and have also a good deal of work in progress at their Stockton establishment. Messrs. Harkess & Son are preparing to launch next spring tide two steam trawlers, built to the order of Messrs. The Western Steam Trawling Co., Limited, of Bristol. Both vessels are to be launched on the same day. The firm have in the framing stage a steel steamer ordered by Norwegian owners, and which is intended for employment in the fruit trade between Norway and America, and have in a still earlier stage of progress a vessel of 2,000 tons deadweight. On the slipway, the fast twin-screw steamer *Elise Cerana*, which has been built by Messrs. Harkess & Son for the River Plate passenger service, is having her hull cleaned and painted, preparatory to proceeding to Arbroath, where her engines, which have been constructed by Messrs. Alexander Shanks & Son, will be fitted. The vessel will not again return to Middlesbro', but will proceed straight to her destination, when she leaves the hands of the engineers.

Darlington.—At this centre the steel works continue to show great activity, and as specifications still come in freely, the briskness is likely to be maintained for some time to come. No orders of importance have recently been booked by the Darlington Forge Co., but that circumstance will not materially affect the state of business in the establishment for many months yet, as the contracts secured by the company, and yet to be dealt with, are very numerous.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—From an industrial point of view, the position of the shipbuilding trade of the North-west of England is all that could be desired. It is full of life and activity, and every department is very fully and very briskly employed. There is not, however, a large demand for shipping, and orders for new tonnage are few in number, and are not being pressed on the attention of builders. There is this fact, however, in favour of the present position. Builders could not hope, with prices of building material at so high a point, to command many orders for shipping, and it became the evident policy of shipowners to defer orders until tonnage could be more cheaply built; but with the fall in prices of plates, angles, &c., there is also a slackening in the shipping trade, and a lessened demand for new steamers. On the other hand, there are large Atlantic and other companies who are periodically compelled to make additions to their fleets, in order to keep pace with ordinary competition and with the general requirements of trade, and it is natural that orders of this character will, if possible, be placed at a time when the value of material is at a low point. There is good reason to believe that this course will be adopted by some of the largest shipping companies afloat, and that shipbuilders will profit by orders from these quarters during a period which otherwise would be one of stagnation in the trade. Barrow is in a fair way of receiving important orders of this nature. The work in hand at present is sufficient to maintain activity at the Barrow yard for the remainder of the year. All the orders in hand are of a character requiring early attention, and this is particularly the case with the order for three high-class full-speed twin-screw steamers for the Canadian Pacific Railway Co. It is interesting to note that the mode of treating the propeller shafts in these steamers will avoid any possibility of mishap such as that which recently occurred to the *City of Paris*. The propeller shafts will not work in tunnels, but will be exposed, and thus easily tended and watched. Much progress has been made at Barrow with the building of the three second-class cruisers for the Admiralty, and it is expected that the first of these vessels will shortly be launched. The strike of joiners at the yard of the Naval Construction and Armaments Co. has terminated, the men resuming work on the 22nd inst., after a strike extending over five or six weeks, on an advance in wages of 2s. per. week. The greatest activity is reported in the engineering departments. There is a perfect deluge of work, and this is made all the more striking at the Barrow yard by reason of the fact that not only are the engines and boilers in hand for the three Canadian Pacific Co.'s steamers and the three second-class cruisers for the Admiralty, but there are also in course of construction two sets of triple-expansion engines for the Pacific Steam Navigation Co.'s steamers *Patagonia* and *Aconcagua*, which will come round to Barrow during the summer for alterations. Efforts are again reported as being made to dispose of the shipbuilding yard of the Graving Dock Shipbuild-Co. at Barrow.

Whitehaven.—Several overtures and inspections have been made with a view to the acquirement of the Whitehaven Shipbuilding Co.'s yard, which is now on sale at the hands of the directors of this unfortunate concern, but up to the present time no definite or practical offer has been made which is likely to lead to a transfer of the works and yard and a resuscitation of shipbuilding operations.

Workington.—A fairly steady and active trade is being done at the Workington shipbuilding yard, but there is not much prospect of new work after the present orders have been completed.

Maryport.—There is a fairly active trade in shipbuilding at Maryport, but a strike of platers and rivetters which occurred last week at Messrs. Ritson's ship yard threatens to put a stop to all operations unless it is soon settled. The men want to be paid on the price list of the Tyne and Wear. Messrs. Ritson say they are not in a position to give the men the advance in wages at present which the adoption of this list would mean.

THE MERSEY.

THE steadily decreasing activity in the shipbuilding and marine engineering industries of this district, to which reference has been made in previous reports, continues, and is now making itself, if not seriously, at any rate unmistakably felt. There is still sufficient work in hand to keep the shipyards and engineering works mostly well employed, but there is almost a complete absence of new work coming forward. The shipbuilders on both sides of the Mersey report that not only are no new vessels being given out, but there are no enquiries. The repairing yards are also not receiving anything like the same quantity of work that they were a short time back; and it follows, as a necessary consequence, that there is a decided falling off in the orders given out to marine engineering firms. The causes which have contributed to bring about this result were pretty clearly pointed out last month, and to a large extent they still exist. The falling off in freights would, of course, under ordinary conditions tend to check the building of new vessels; and this, no doubt, is having its effect upon the shipbuilding industry, but apart from this there is a general feeling of unsettlement with regard to the future which is inducing a policy of waiting all round. The reckless speculation in the iron markets at the close of last year, and the undue forcing up in the price of all descriptions of raw material, which has since been followed by a collapse more speedy and complete than has perhaps ever before been experienced in the trade, has had the effect of disorganising all branches of industry connected with the iron trade. The rapid and persistent downward movement in both raw and manufactured iron and steel during the past three months has fostered the belief that everything must fall back to something like the old low rates, and it is only under the most pressing necessity that any new work, either in shipbuilding or marine engineering, is now being placed out. The fall in the price of raw material has, of course, placed shipbuilders and engineers in a position to entertain new work on more favourable terms than they could have offered three or four months back, but they are quite unable to move with regard to wages. In fact, the tendency of wages continues in an upward direction, and during the past month the engineering works in the Liverpool district have been compelled to concede to their men a further advance of two shillings per week. The workmen for the present seem to be complete masters of the situation, and so long as shipbuilders and engineers have work in hand to keep them well engaged, and which they are bound to complete, they have little chance of successfully resisting the demands which the workmen may put forward. Of course, as existing contracts run out, and are not replaced, employers will be in a better position for dealing with their workmen, but outside marine engineering there is an immense amount of general contract work going on in railway extension, bridge building, canal construction, and other enterprises which for some time must keep up a large demand for labour, and the returns issued by the engineering trades union organisations show no present falling off in the demand for workmen. The percentage of unemployed on their books continues exceptionally small, and so long as this is the case the trade union leaders are not likely to entertain any considerations that involve a lowering in the present rate of wages. It will thus be seen that the outlook is one full of difficulties. Labour is maintaining itself at a much higher point than is at all justified by the prospects of trade, and the position both of makers and manufacturers of iron and steel is, perhaps, even much more serious than that of other industries in which the raw material has to be manufactured into finished work. The prices now current for all descriptions of iron and steel have fallen considerably below the actual cost of production, and there seems to be little probability that pig-iron makers will be enabled to obtain sufficient concessions in the price of fuel,—which is one of the chief items of cost—to at all counterbalance the fall which has taken place in the price of iron and steel, whilst wages in most departments are more than likely to remain at their present high point. The return to low-priced raw material will, as already pointed out, necessarily help to place shipbuilders and marine engineers in a more favourable position, but it seems very questionable whether they will not still be so heavily handicapped by the high price of labour as to prevent their meeting the completely revolutionised views of those who have work to give out as to the terms on which, if they only wait, they will be able to place it.

With regard to shipbuilding, visits paid to various shipyards on both sides of the Mersey elicited in every case the same report. They are all simply going on with work they have had in hand for some time past, and since the commencement of the present year there has been practically no new work of any importance given out, nor are there any indications that new vessels are likely to be ordered for the present, except it is in the case of regular liners, the building of which may become an absolute necessity.

Messrs. Laird Bros., of Birkenhead, are very full of work, but this is largely on contracts for English and foreign Governments, and the completion of these will keep them well employed for a very considerable time to come. They have been doing some repairs to the *City of Paris*, which at present is lying in the big float at Birkenhead, pending the Board of Trade enquiry, but there are reports that the vessel is likely to be sent to Glasgow to be placed in the hands of the builders for the extensive repairs which will be necessary in her engine-room.

The first of two torpedo gun vessels which Messrs. Laird Bros. are building to the order of the Argentine Government Confederation has just been completed, and was launched from their Birkenhead works on Tuesday, the 22nd ult. This vessel was named the *Espora*, after one of Admiral Brown's most distinguished officers in the war of independence. The christening ceremony was performed by Senora Garcia, wife of Captain Samuel José Garcia, of the Argentine Navy, who is now representing his Government in Europe in the torpedo branch of the service, and under whose supervision the vessels are being built. In addition to Captain Garcia there were present Captain F. Spurr and Captain Cabassa of the Argentine Naval Commission, Captain Scott Brown, Captain Loqui, and Captain Betbeder, and other officers of the Argentine Navy, and a large party of ladies and gentlemen. The *Espora* may be shortly described as being of the *Rattlesnake* type, but to have higher speed, lighter draft of water and various structural improvements suggested by recent experience; her length over all is 210 ft.; beam, 25 ft.; depth, 13 ft. 6 in.; tonnage O.M., 615 tons, and she will be fitted with twin screws, driven by two sets of triple-compound engines, which collectively are of 3,250 H.P., and supplied with steam at 150 lbs. pressure, by four steel boilers of the locomotive type. The hull is built entirely of steel, with a ram stem, and is divided into upwards of thirty water-tight compartments, whilst the coal bunkers are arranged to afford protection to the machinery, each set of engines and each pair of boilers being in separate compartments. The armament will consist of Nordenfeldt quick-firing guns; two 14-pounders, mounted one on each side of the forecastle, each commanding a range across the bow and 75 degs. abaft the beam on its own side; one 8-pounder at the end of the poop, having a range from 65 degs. before the beam on one side to the same on the other side; two 3-pounders at the fore end of the poop, each firing right aft and 70 degs. forward of the beam; and two Gatling guns. Five torpedo tubes are in the bow, and two on each broadside, fitted for discharging the new 18-inch Whitehead torpedo, these vessels being the first to be equipped with this improved missile. The second of these vessels is rapidly approaching completion, and will be launched in a very short time.

Messrs. W. H. Potter have, during the past month, launched an iron screw steamer, which has been built for the China trade for Mr. Alfred Holt, and which is the fourth of the same dimensions that has been built for the above firm. The vessel has been christened the *Gorgon*, and her dimensions are as follows:—Length, 234 ft.; breadth, 34 ft.; depth of hold, 15 ft. 8 in.; tonnage, net register, about 880 tons. Messrs. Fawcett, Preston & Co. have supplied the engines, which have cylinders 21½ in. and 46 in. diameter respectively, with a stroke of 36 in. The *Gorgon* is fitted with Messrs. Clarke & Chapman's patent steam windlass, and Kingsley & Sons patent stockless anchors.

In general engineering work, Messrs. Wilson & Co., of Sandhills, Liverpool, have just introduced a new single chain grab (Price's patent) for dock and other excavation work. The main feature of this new grab is that it dispenses altogether with the ordinary barrel for opening and closing, and which was necessarily very much in the way when the grab had become filled with material. The opening and closing of the jaws of the grab is effected by means of arms, which, when the grab is loaded with material, are outside the bucket; whilst, when the jaws open, the arms descend and act as scrapers for clearing away any soft clay which may have lodged in the grab. This improvement, whilst it greatly simplifies the construction of the grab, renders it also much more efficient in its work, and two of these new grabs have been supplied for the Manchester Ship Canal works at Eastham. Another improvement the above firm have introduced in connection with dock construction is the manufacture of cast-iron piles to replace the ordinary wooden piles for the building of dams; these are made interlocking so that there is no chance of their separating when coming in contact with stones or other hard material when being driven down. A large number of these are also being supplied to the Ship Canal Co.'s works. Messrs. W. Muir & Co., of Manchester, have in hand several machine tools of an improved type, specially designed for marine work. Noticeable amongst these is a horizontal drilling, tapping, studding and boring machine, having a range of 12 ft. vertically, and 15 ft. horizontally, capable of drilling stud-holes from ½-inch diameter, and boring holes up to 2 ft. diameter. All the motions of this machine are moved by power, and they are all actuated from the position where the attendant stands. One of these machines is at present being made for a marine engineering works at Liverpool. Messrs. Muir have also in hand an exceptionally powerful planing machine for one of her Majesty's dockyards, which is of the most recent improved type. The machine is constructed to plane 30 ft. long and 6 ft. square. It has two tool boxes on a cross slide and one tool box on the large upright. As this machine is required to plane hard steel, cast-iron and brass, the speeds are arranged accordingly, the return operation of the table being constant with the varying cutting feeds, and this arrangement, it may be added, has been patented by Mr. Alfred Muir.

In the iron market the month closes with an extremely depressed tone throughout all departments, and there has been a further very considerable giving way in prices without, however, bringing forward business. Indeed, the persistent downward movement in warrants would seem rather to check than to stimulate buying, and any transactions that are put through are for the merest hand-to-mouth requirements. These, for the most part, are being covered either by purchases of warrants or secondhand parcels which are offered at exceedingly low figures that have no relation whatever to makers' quoted rates, and there is a weakness and irregularity all through the market that render it almost impossible to quote any actually fixed price. Local and district brands of pig-iron are nominally quoted at about 55s. and 56s. up to 60s. according to brand, with Eglinton obtainable delivered at the Lancashire ports at about 51s. to 52s., or equal to Manchester at about 56s. to 56s. 6d., and good foundry brands of Middlesbro' delivered equal to Manchester at 55s. 6d. to 56s. net cash. All branches of the finished iron trade are in an utterly stagnant condition, local forges being only very partially employed with makers open to entertain low offers for prompt specifications, the current quoted rates being about £7 10s. to £7 15s. for Lancashire, and £8 for North Staffordshire bars, delivered in the Manchester district. Nut and bolt makers report a decided falling off in the demand, and they have found it necessary to give way upon their list rates to secure business.

Very much the same remarks apply to the steel trade, both in raw and manufactured material. For hematites there is little or no enquiry, and 70s. less 2½ is now the full average price for good foundry qualities delivered in the Manchester district. There is almost a complete absence of demand for steel plates for either shipbuilding or boiler-making purposes, and prices are very irregular. Steel boiler plates, delivered ex-steamer Liverpool, are quoted by Scotch houses at £9 7s. 6d. per ton, steel ship plates at £8 7s. 6d., and angles at £7 7s. 6d. These prices, however, are altogether out of the market, steel ship plates being offered from other districts at as low as £7 15s. per ton. Steel boiler plates delivered to consumers in the neighbourhood of Manchester are quoted by Scotch houses and also by local makers at £9 10s. per ton, but these figures are altogether unobtainable, as there are steel plates from east coast districts obtainable at £8 15s. per ton. There is, however, really nothing doing either in ship or boiler plates to test prices, and any quotations are for the present little more than nominal.

In the metal market rather more enquiry for some descriptions of manufactured goods has been coming forward towards the close of the month, but generally the demand continues extremely small, and prices show a want of firmness. For delivery, equal to Manchester or Liverpool, list quotations are as under:—Solid drawn brass boiler tubes, 7¾d.; solid drawn brass surface condenser tubes, 9¼d.; solid drawn copper tubes, 10d.; brazed copper steam tubes, 9¾d. per lb.; copper bolts, £10 per ton; yellow metal bolts, 6¾d. per lb.; yellow metal condenser plates, 6¾d.; brass wire, 7d.; best red wire, 8½d.; copper wire, 8¾d.; rolled brass, 6¾d. to 7¼d., and solid brass, 7¾d. per lb.; cast composition sheathing nails and spikes, according to size, 8d.; do. red metal, 10d.; wrought copper rivets and washers, 10¼d.; wrought copper boat nails from 10d. to 11½d., according to size; and cut copper nails from 10¼d. to 11¾d. per lb., according to size.

In the timber trade the arrivals during the past month have been only limited, and the demand, though fair, has been somewhat interfered with, owing to troubles in the labour market. Stocks generally are heavy, and values of most articles have shown a downward tendency.

In the coal trade, prices for steam classes of fuel are easier, and supplies plentiful in the market—good ordinary descriptions of steam coal delivered at the Garston Docks or the High Level, Liverpool, being obtainable at about 10s. 6d. per ton, although in many cases 11s. per ton is the quoted price.

WELSH NOTES.

A BIG find of coal is reported within a mile of Swansea East Dock, and the local people are jubilant in consequence. Should the coal prove to be of anything like decent quality this should be a good thing for Swansea, and, to a certain extent, minimise the importance of the opening of the new line to the Orbendda Valley. It remains to be seen, however, if the cost of working the coal at the new field does not mount up rather high.

The tin plate people, as we said in our last, have been in a bad way, and as a remedy the men had recourse to a "stop week." This did not prove so satisfactory as was expected, so a second stop week has been decided upon. This system certainly tends to reduce stocks, but the secret of the matter appears to be that buyers were keeping off for some reason or another, and with no demand, prices naturally fell. Just at present things are a little stiffer in this line.

Coal prices are down to a much more reasonable level. It is scarcely possible that the old limit on the down-grade will be touched, but that the high prices recently ruling will be paid again is unlikely. The men know their power now more than ever they did, and will indulge in stop weeks should they find selling prices reduced to a figure which would interfere to any considerable extent with their wages.

The long-continued dispute between Messrs. Mordey, Carney & Co., Limited, and the Boilermakers' Society has at length been settled. The result is practically a win for the men. In future all the ironwork is to be done by members of the Boilermakers' Union, and the carpenters who have hitherto done the work are to be discharged, unless they join the society. It is not stated, however, whether or not the action brought by the employers against the society in connection with the boycotting has been withdrawn or not.

The Bute Shipbuilding, Engineering, and Dry Dock Co., Limited, Cardiff, have launched during the past month a large steel steamer for Messrs. F. Woods & Co., of London. The steamer's dimensions are 310 ft. by 38 ft. 6 in. by 23 ft. 3 in., and she is expected to carry about 3,850 tons. It is stated that the owners are so well pleased with the vessel that they are prepared to give the Bute Co. an order for a second vessel. The chief difficulty the builders have to contend against is the difficulty in securing the necessary number of men to enable them to give reasonable delivery. This is what the builders say; but it would be interesting to know if the experiment proved a financial success. There has hitherto been more glory than profit about Welsh shipbuilding.

The trade of Swansea Harbour is steadily increasing. For March exports 187,439 tons against 165,683 for the corresponding month of 1889. For the first three months of this year the trade shows an increase of over 20,000 tons. With the opening of the Rhondda and Swansea Bay Line this month the prospects of Swansea should still further brighten. By the way, the value of the

has lately increased on London buying.
will pay well.
(chiefly noted on account of the con-
the South Yorkshire Building Society)
auction the other day, but as the reserve
property was withdrawn. The reserve
vendors was £37,500.

a son of the vice-chairman, has been
ector of the Barry Dock & Railway Co.
the Taff Vale Co. will shortly endeavour to
Barry people with a view of increasing the
the Rhondda Valley to the shipping places.
e Taff directors to do something to improve

AST TRADE NOTES.

same rush and activity in the engineering
ling trades here as was some months ago,
ms are fully employed.

& Wolff, Queen's Island Works, have handed
tive owners the s.s. *Majestic*, s.s. *Alexander Elder*,
r-masted ship *California*, they have now the
ancras, *Imaum*, and *Michigan* at their finishing
being in an advanced state, and will have other
They had the s.s. *Optic*, of the Belfast and Liver-
nd for repairs and Board of Trade survey during
They have taken additional ground from the
Commissioners for extension of their works.

kman, Clark & Co. have some ships rapidly
mpletion, and will launch one to the order of Messrs.
., Dublin, shortly.

y of Vienna, recently launched by them, has been
gow to receive her machinery. This vessel is to the
rs. S. Smith & Co., the City Line, Glasgow.

orkman, Clark & Co. have taken from the Harbour
ers a large extent of ground convenient to the new
k, and we understand that Mr. Allan, jun., Glasgow,
enter the firm, and that extensive engine and boiler
be erected on the ground taken; this will be of vast
Belfast, Messrs. W. & C. having up to the present had
mers built by them, with a few exceptions, engined in

MacIlwaine & Macoll, Limited, are busy at present and
of orders ahead. They have almost ready for launching
teamer for Mr. Fisher, Barrow, to be fitted with triple-
on engines, having cylinders 17 in., 27 in., and 44 in. by
troke, and boilers to work at 160 lbs. pressure.

are pushing forward rapidly a very large set of triple-
sion engines for a steamer building by Mr. C. J. Biggen,
Shipyard, Derry, to the order of Messrs. Johnston & Co.,
pool. These engines are a contract begun by Messrs.
ter, Liverpool, work on which had been commenced, but
have been taken over by Messrs. MacIlwaine & Maccoll; the
lers are 36 in., 42 in., and 67 in. by 51 in. stroke. They have
in hand four large land boilers, to the order of the Belfast
poration, for the Belfast Gasworks.

The s.s. *Minnie Hinde*, recently launched by them, has made the
ssage from Whitehaven to Belfast (86 miles) in 6½ hours.

Messrs. Victor Coates & Co., Limited, are busier at present than they have been for a considerable time past. The Belfast, Bangor and Larne steamers are in their hands for their annual overhaul and Board of Trade survey, preparatory to their season's work. They have also the machinery for the steamer building by Messrs. Workman & Clark, to the order of Messrs. Tedcastle & Co., Dublin, in an advanced state.

Mr. Paul Rodgers, Carrickfergus, amongst other work has in hand a yacht for Mr. McGildowney, owner and designer of the *Melissa*, and she is expected to be very fast. This vessel has also been designed by Mr. McGildowney.

Mr. Thomas Norris, yacht and boat builder, Prince's Dock, Belfast, has just turned out the schooner yacht *Pleone* ready for the season, after a very extensive repair, the vessel having been driven on the rocks convenient to Bangor, co. Down, during one of the severe gales at the end of last year, and very badly injured.

The Steam Navigation Co. of Ireland (John Burke & Co., managers), have ordered a large steamer in Sunderland. This company offered, during the month, £10 per month to a second engineer for their s.s. *W. C. Mitchell*, engaged in the Atlantic trade, and as this is considerably under the port wages here, and is considered an attempt at reduction, we learn that a branch of the Marine Engineer's Union will probably be opened in Belfast.

The question of reducing the rates on goods was under the consideration of the Belfast Harbour Commissioners at their last meeting, a deputation representing the shipping companies having waited on them in regard to same. After considerable discussion the consideration of the question was adjourned until after the effect of the Merchant Shipping (Tonnage) Act, 1889, shall have been ascertained.

The new floating dock is rapidly taking shape in the hands of the contractors.

The new steam cranes ordered by the Commissioners are arriving.

The Harbour Commissioners have given notice that as reports have appeared in the Press that the new channel was navigable, that all ships entering such do so at their own risk, the lighthouses about being erected by the Harbour Commissioners not being in position, nor the channel buoyed.

Messrs. Robinson, Hill & Co. have had a very busy season in ship repairing, and at present are fully employed.

The death of Mr. William Hinde, a very extensive coal merchant and owner of the Hinde Line, took place during the past month.

The s.s. *William Hinde*, of the Hinde Line, has been sold to a Glasgow firm for about £6,500.

The s.s. *Ballydoon*, of Belfast, 79 tons gross register, built at Paisley, 1878, dimensions 65·1 ft. by 18·2 ft. by 7·7 ft., has been sold to Mr. A. Ross, Glasgow, for £1,050.

The first compound locomotives we believe in Ireland was landed here by the Belfast and Liverpool steamers during the past month. Four have been ordered by the Belfast and Northern Counties Railway Co. from Messrs. Beyer, Peacock & Co., Limited, Manchester. They are on the Worsdell & Borrie's system, and the working of the two just arrived will be watched with interest.

LEITH NOTES.

THE shipbuilding and engineering trades here still continue fairly brisk, a large number of repair orders having come to hand. All the local firms are equally busy. Messrs. Ramage & Ferguson have secured the contract for gutting out the North of Scotland Co.'s s.s. *St. Nicholas*, and fitting in new engines and boilers, while Messrs. Morton & Co. are employed on the Ben liner, *Benledi*, and two of the London and Edinburgh Shipping Co.'s boats, Messrs. Hawthorn & Co. and Messrs. Cran, Albert Engine Works, being both busy on small orders. On their patent slip, Granton, Messrs. Hawthorn & Co. have finished the annual overhaul of the Northern Lights Commissioners' p.s. *Pharos*, and have now the s.s. *Tana* on hand.

Of new orders placed, Messrs. Ramage & Ferguson have received orders to build a fine steel steam yacht of 300 tons register, and Messrs. Gourlay Brothers, Dundee, have contracted to build a large steamer for a French house.

On April 5th, Messrs. Hall, Russell & Co., Aberdeen, launched the *Duchess of Fife*, a handsomely-modelled steel screw steamer of 700 tons gross register, built for the Aberdeen Line Co. On the same day, Messrs. A. Hall & Co., Footdee, launched the *Jaboatao*, 750 tons gross, built to the order of the Companía de Navigacao de Pernambuco. On the 7th inst. Messrs. S. & H. Morton & Co., Leith, launched the *Baracoa*, a fine steel screw steamer, built to the order of Messrs. Harloff & Boe, Bergen. On the 19th inst. Messrs. Ramage & Ferguson launched a fine steel screw steamer.

The Grangemouth Dockyard Co. have launched two steamers during the month; on the 9th the steel screw steamer *Georg Dumois*, built to the order of Mr. Canble, of Bergen; and on the 19th the steel screw steamer *Moss Rose*, built to the order of Mr. Richard Hughes, of Liverpool, and intended for the coasting trade; Messrs. Hutson & Corbett, Glasgow, will supply the engines for the latter vessel.

The steamer *Barnes*, built to the order of Messrs. Harloff & Boe, Bergen, and the large steamer *Edith*, built for Messrs. Robinson Brothers, of Whitby, by the same builders, had trial trips during the month, and left for their respective destinations. Messrs. Hutson & Corbett, Glasgow, and Messrs. Alley & M'Lellan, Glasgow, respectively supplied the engines.

In the middle of the month a strike arose among the carpenters employed in Messrs. Scott & Co.'s yard at Kinghorn, due to the foreman dismissing two men. The firm ordered the men to lift their tools, as all belonged to the union, and they will work in future with non-union men.

The coal trade in the Firth of Forth is much easier, and the amount of shipments for this month up to date exhibits a considerable decrease on that of last month.

On the 6th inst. an extraordinary accident occurred on the Bell Rock Lighthouse. Recently a gun cotton explosive fog signal was fitted up, and on the 17th March it was fired for the first time. The charges are connected by the wires of an electric fuse and detonator to an electric cable, attached to a jib fitted through the roof of the lighthouse, and connected to a small magneto-electric machine inside the light-room. About ten o'clock on Saturday night one of the charges exploded prematurely, blowing out all the glass of the dome, and damaging the lighting machinery and also that for ringing the two large fog bells. The Bell Rock Lighthouse was erected by Robert Stevenson, the light being shown for the first time on the 1st February, 1811. Since then until Saturday night the light has been shown without intermission, nor has any loss of life occurred on the Bell Rock, where, previous to the erection of the lighthouse, the most disastrous fatalities to shipping frequently occurred.

EDINBURGH INTERNATIONAL EXHIBITION.

THIS undertaking, which we have from time to time shortly noticed, is now on the eve of completion, and on the 1st May will be opened with becoming ceremony by T.R.H. the Duke and Duchess of Edinburgh. Her Majesty the Queen has also graciously extended her patronage to the undertaking, and will probably visit the Exhibition in state during the autumn. The conception of the project of holding an Exhibition in Edinburgh in 1890 lay with quite a few gentlemen of Edinburgh and neighbourhood, who deemed the opening for public traffic of the great triumph of civil and mechanical engineering—the Forth Bridge—a fitting opportunity for demonstrating what progress was being made in another department of engineering, viz., that concerned with electricity. The scheme originally contemplated was most modest in its scope, but its subsequent history has been one of continuous growth and expansion until now, on the eve of its opening, the scheme is seen to amply warrant the more comprehensive title of "International Exhibition of Electrical Engineering, General Inventions and Industries." The site selected for the exhibition—now that the buildings and their varied contents and the grounds and outside features of interest are in a state of completion—is a most suitable one. It is in the North Merchiston district of Edinburgh, close to the Craiglockhart Hydropathic Establishment, and within half an hour's walk of the centre of the city; but accessible from all quarters, both by tram and rail, in such a degree as to amply justify the promoters in having eschewed a site nearer the heart of the city. The grounds on the north are bounded by the main line of the Caledonian Railway. On the south are the Union Canal and the tramway lines from the heart of Edinburgh. Dividing the grounds into two almost equal portions is the North British Suburban Railway, which here traverses a deep cutting, over which the passage-way and bridges connecting the two main portions of the buildings are carried. The trams will deposit their carloads opposite the main entrance, while the railways will each set down their passengers at stations erected within the grounds. Added to these advantages of travel, and to the good things of the Exhibition itself, visitors may enjoy the pleasures of scenic environments which are not destitute of quiet beauty. Villadom itself almost ceases where the Exhibition begins and from the grounds, which are in themselves exquisite examples of the landscape gardener's art, one's eye may rest on the Corstorphine Hills to the north of the Craiglockhart Hill or the more distant Pentlands to the south-west.

The site altogether extends to about fifty acres, and of this about 370,000 square feet are occupied by main buildings—leaving out of count the numerous outside covered-in features, such as kiosks, cafés, panorama, Japanese village, &c. The buildings comprise two main portions, with their various "annexes," separated by the Suburban line of railway above referred to, yet connected by the covered passage-way spanning the railway. The eastern main building is devoted to general inventions and industries, music and the fine arts, &c.; while the western main building more particularly embraces the electrical exhibits, and the machinery in motion. The semi-independence of these two main portions is a feature in the arrangements which will be much appreciated by visitors. By this means the discomfort to listeners in the concert hall or to visitors to the fine arts and miscellaneous general exhibits arising from the noise and heat due to the proximity of the machinery-in-motion department will be completely obviated. The eastern main building is about 700 ft. long by about 300 ft. broad. It is divided into two by the spacious concert hall, which measures 200 ft. long by 100 ft. broad. Receiving visitors from the main entrance and affording entrance to this hall is a main vestibule 100 ft. square. The space to each side of the concert hall and grand vestibule is devoted to the courts containing British and Foreign general exhibits. At the north-west corner of this main building a flight of steps leads down to the sculpture gallery, and at the further end of it are arranged on either side the art galleries, including sections for all branches of art and designing.

The Machinery and Electrical Hall, although somewhat plain externally, is perhaps the most interesting building in the whole group. It measures 680 ft. by 150 ft., and has been built entirely of battens, held together with wrought-iron bolts, and reflects great credit on both designer and contractor. The central space of this hall is 80 ft., and the girders, which are supported on wooden pillars, are 39 ft. high, and 20 ft. apart. On either side of the central arch is a small span of 20 ft., and at the extreme outsides is a series of bays 15 ft. wide, bringing the total width up to 150 ft. These bays are roofed so as to form a series of gables along the sides of the hall. Alongside the Machinery Hall a building has been constructed of brick for the boilers, of which there are to be five, supplied by the well-known Messrs. Galloway. In juxtaposition an annexe has been erected specially for locomotives and railway rolling stock, and five representative engines will be shown, as well as some recently constructed carriages and wagons from America. Here will also be located a historical collection of early locomotives and engines. So complete are the arrangements that the locomotives will be allowed to steam into the position in which they will finally stand.

Among the less important structures may be mentioned the Sculpture Gallery above referred to. This is 100 feet long and 40 feet broad, and 33 feet high. The roof is formed of three arches, the centre space being 20 feet, and the side corridors 10 feet each. The same treatment has been followed in constructing the side passages as that adopted in forming the passages of the Machinery Hall. Leaving the Sculpture Gallery by another flight of stairs 20 feet wide, we enter the Art Galleries. These are seven in number, including the central archway, which is 40 feet wide by about 90 long. The galleries proper run to right and left of the archway, three on each side, and are 60 feet by 30 feet. The walls and flooring are similarly built to those of the main building, but the roof is slightly differently treated. They are lined to a height of 12 ft. with a cornice at the top. The North Gallery for general exhibits is connected with the art galleries. This building is about 300 ft. long by 100 ft. broad, and in it the process of the manufacture of furniture is intended to be shown.

Throughout the grounds there will be a large number of buildings, quaint in design and ornamental in appearance, for cafés, restaurants, &c. In a circuit of the grounds from the bridge at the main entrance, the first building attracting attention is a Venetian glass factory, the entrance porch of which is being modelled on the exact lines of that at the Doge's palace at Venice. Here twenty glassworkers will be occupied producing for sale those varied artistic objects for which the Italians are so deservedly noted. The manufacture and sale of Swiss articles will be carried on inside a chalet, and there will also be an exhibition of Swiss amusements. A panorama in a circular building of wood is to represent the battle of Trafalgar, and is being produced by the Scottish Panorama Co. At the west end of the main building is a separate structure, in which a typical Japanese village, with native inhabitants and workers, is to be laid out. This building has been put up by parties who have got a concession. It is 120 ft. long and about 70 ft. wide. In its construction corrugated iron is largely used. The roof is of T iron principals with wooden purlins. In the western grounds there is a circular garden, with a bandstand in the centre, surrounded with flower plots, while around the outer circular drive is a series of ornamental kiosks, refreshment rooms, and club-houses for the Executive Council, exhibitors, and for the female attendants of exhibitors. An exact copy on a reduced scale of the well-known Hampton Court Maze is laid out in a building near the terminus of the electric railroad. A gipsy camp and an ocean wave—a sort of circular switchback, with boats, instead of the ordinary carriages—will probably prove great attractions.

We will in our next issue give another notice of this Exhibition, which promises to be a most important one.

THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.

A Paper recently read before the Institute of Marine Engineers, by Asplan Beldam, Esq., *President of the Institute.*

(Continued from page 19.)

We now come to the introduction of the "screw propeller." It is said that Smith first introduced the screw propeller in this country, and Ericsson in America. The same kind of engines were used for driving the propeller as were used for paddle vessels; the high speed given to turn the propeller was by means of gearing. I regard this as being one of the most important epochs in the history of the steam-engine, as suitable for steam propulsion.

The first British steamer of any size fitted with a screw propeller was the *Archimedes*, 237 tons, and built on the Thames in 1839. It was tested by the Admiralty between Dover and Calais with the fastest paddle-wheel mail packets on the station, and so satisfactory were the results, that the Admiralty felt justified in introducing the screw propeller into the Royal Navy, the *Rattler* and other vessels being fitted accordingly. The *Great Britain*, built in 1843, was the largest vessel of that day; and was remarkable not only for her size, but also because she was built of iron, and propelled by a screw instead of paddles. She was 322 ft. over all in length, 48 ft. 2 in. broad, and 31 ft. 5 in. deep, with a gross tonnage of 3,270, and built to the designs of Brunel, at Bristol. I believe at the first, she was engined by Mr. Guppy, with one of the first direct-acting engines made, and afterwards re-engined by John Penn & Sons, Greenwich, her engines being geared to the propeller shaft. The *Great Britain* made her first trip across to New York in fifteen days, and afterwards (for many years) was well known in the Australian trade. Gradually, as ocean steamship trade increased, and the necessity arose for extending to foreign countries (where coal was expensive, and could not be readily obtained) engineers turned their attention to a higher pressure of steam, which was thus gradually increased. Amongst those who led the way in design and construction of engines of a more economical type, are the names of John Elder, Charles Randolph, John Rowan, Edward Humphrey, Rennie, Penn, and Maudsley. These all deserve special mention. The first vessel fitted with compound engines by Randolph, Elder & Co. was the screw-steamer *Brandon*. On her trial trip, in 1854, her consumption of coal was found to be about 3¼lbs. per I.H.P. per hour; and the previous general consumption being about 4lbs. to 4¼lbs. A similar type of engines had been made and used extensively for land purposes by Hornblower and Wolff; but Randolph and Elder were the first to employ them for marine purposes.

In 1856 Randolph and Elder engined two vessels for the Pacific Steam Navigation Co., the pressure of steam being about 25 lbs. above the atmosphere. The condenser was of the old-fashioned jet description, and on service the consumption of coal was 2½ lbs. to 3 lbs. per I.H.P., being the most economical marine engine of the day. The *Valparaiso* was the name of one of these vessels.

The same firm also took up the receiver type of the compound engine at an early period of its history, and from the years 1867 and 1868 a rapid increase in the use of the compound engines took place, and in a few years they became universal to the Mercantile Marine.

Steam pressures soon went up to 80 and even 100 lbs.; thus considerably improving their efficiency, and bringing down the consumption of coal to about 2 lbs. per I.H.P. per hour, and in some cases less; but this great saving in fuel cannot be attributed solely to the high working pressure of steam, nor to the compound principle on which it is worked, but to the "surface condenser," which, in my opinion, has done more towards perfecting the marine engine than any other invention. We are indebted to Mr. Hall, of Dartford, for the introduction of the "surface condenser" (about the year 1838) which, however, did not come into general use till many years later. Mr. Hall's condenser only failed because he did not sufficiently provide for the expansion and contraction of the metal tubes; and owing to the inability of keeping the tubes tight, surface condensation was thrown back several years, and we are now indebted to several other well-known engineers for their endeavours to perfect the "surface condenser." Mr. John Frederick Spencer, of London, spent much valuable time and money to this end, and was the first to introduce the india-rubber packing at the end of the tubes in order to get over the difficulties experienced by Mr. Hall.

The salting up of the boilers was a great difficulty in the way of the development of the marine engine, and, but for surface condensation, we should not have had the present compound or "triple-expansion" engine. By its introduction was obviated the direct waste of heat, necessitated by continuously brining or blowing-off part of the water from the boilers, and this, combined with the greater degree of expansion, rendered impossible by the adoption of compound engines, working with higher steam pressures, had the desired result of reducing the coal consumption in proportion to the power developed, by more than one-half; or, we may say, that from the adoption of the compound engine to the year 1872, marine engineers had doubled the working efficiency of the marine steam-engine. The result of this economy was a large development of steam shipping, inasmuch as it enabled the shipowner to employ steamers profitably in trades from which they were previously shut out; while larger and more powerful steamers of the then modern type took the place of older ones. Owners of passenger lines went in at all risks for very large and powerful steamers, amongst the most enterprising of whom were those in the Atlantic passenger trade, the Cunard Co., the Inman Line, the Allan Line, and the White Star Line. Here mention of the White Star Line recalls to my memory their first steamer, the *Oceanic*, starting on her first voyage from Liverpool to New York. I resided in Liverpool at that time, and the town (at least all those who were interested in shipping) was all excitement. To this company much credit is due, for the high rate of speed and the luxurious and comfortable mode of travelling which now exists, and although much was said about the proportions of these steamers at the time (in fact, public opinion was against them), the owners and builders (Messrs. Harland & Wolff) had every confidence in them, and it is needless to say that their expectations were fully realised. It is also a well-known fact that the performances of these steamers awakened the other steamship owners in the Atlantic trade, and led to the high rate of speed which is now attained. To the managing owners of this company (Messrs. Ismay, Imrie & Co.), the marine engineer and naval architect are indebted for the opportunities given of displaying their abilities and showing to the world what can be done.

The White Star Line were soon followed by the Guion Line, with their *Arizona*, built by Sir William Pearce. The speed of this vessel proved superior to that of the White Star vessels. The greatest power developed in any of the Atlantic Liners previous to the *Arizona* was about 5,500 I.H.P., on a piston speed of about 600 per minute. The *Arizona* had cylinders 62 in. diameter, the high pressure, and two low-pressure cylinders, each 90 in. diameter, with a stroke of 66 in., and was at that time considered to be quite an exceptional vessel. Her performances, however, were soon eclipsed by the *Stirling Castle*. This vessel had engines 62 in. diameter high-pressure cylinders, and two low-pressure cylinders, each 90 in. diameter, with a stroke 5 ft. 6 in. and 100 lbs. working steam pressure. The reader of this paper made the specification for this steamer throughout, and superintended the construction, and is pleased to have the honour of saying she was the fastest ocean-going vessel at that period. The *Arizona* (the Greyhound of the Atlantic, however, was not long destined to hold place as the swiftest Atlantic vessel, being soon followed by the *Alaska*, *Oregon*, *Umbria*, and *Etruria*. The two last-named vessels belong to the Cunard Line, and have cylinders each as follows:—high-pressure, 71 in., and two low-pressure, 105 in., with a stroke of 72 in., indicating 14,320 H.P., on a single screw propeller. I cannot pass over these vessels without mention of Mr. Archibald Bryce Douglas, who constructed these engines, and whom I believe to be the only engineer of the present day who has made engines to indicate 14,320 horses through a single propeller, with such success that they have done their work regularly and without a hitch. An engineer who turns out such high-class work—and propels so many thousands of passengers to and fro to their respective ports, at such a high rate of speed, voyage after voyage, and year after year—should not only be respected by his fellow-engineers, but be recognised as a benefactor to his country.

We now turn from the compound engine, in order to direct our attention to the latest type of marine engine, the triple or even quadruple principle.

The first engines made on the "triple-expansion principle" were those made from the designs of Mr. A. C. Kirk (now Dr. Kirk, and of the firm of Messrs. R. Napier & Sons) in 1874, for the steamer *Propontis*, owned by Mr. W. H. Dixon, of Liverpool. these engines had three cranks, and were supplied with steam by Rowan's patent boilers. During the time the boilers held good the engines worked well and gave great satisfaction; but unfortunately the boilers failed, two out of the four having exploded, with disastrous results, at sea.

The boilers were replaced with the ordinary type, working at 90 lbs. of steam, at that time considered a very high pressure. The engines worked well, but could not give the results they were designed for at such a low pressure of steam. I believe, however, I am correct in saying that new boilers have been put in, at a working pressure of 150 lbs. steam, and that these *first triple engines* are now giving great satisfaction, are a credit to the designer (Dr. Kirk), and should also be regarded as *the first triple marine engine* made and fitted with success in an ocean-going steamer.

From the year 1874 (in which I have said the *Propontis* was fitted with the triple engine) to 1881, nothing of importance was done in regard to higher working pressure of steam, than that being used in the ordinary compound engine. I can, however, from the conversation I have personally had with Dr. Kirk on the subject—assure you that it was not the want of confidence, or any misgivings whatever, on his part with regard to the principle. There was for a short time the want of a suitable boiler, or in other words, the need of a boiler which could withstand 150 lbs. working pressure, and at the same time merit the approval of Lloyd's, and the Board of Trade, in order that the shipowner might get his certificate for seaworthiness. Many schemes and experiments were made, amongst them the Rowan, the Howard, the Roots, the Jordan, the Perkins, the Herreshoff, and the Turner boilers (besides others); but all these forms failed or gave so much trouble at sea and expense to the owners, that they had to be abandoned.

The engineer found a friend at last in *steel*, thanks to Bessemer, Siemens, and others, who worked hard and so thoroughly to obtain perfection in this material. Now, by the aid of steel we are able to make the ordinary type of marine boiler for the heavy pressure we now work at. Mention should be made here, that we do not overlook the fact that the engineer has been at work to meet the times with many clever and useful inventions, in the shape of hydraulic benders, flangers, rivetters, and other ingenious tools.

Having surmounted the difficulty of the boiler question, another serious obstacle presented itself (or I may say had for a long time been a great drawback to the engineer), viz.: the want of a shipowner who believed sufficiently in the engineer to give him a *carte blanche* to build a steamer and put in the triple-expansion engine.

Mr. Cornelius Thompson, of the firm of Messrs. George Thompson & Co., London, sailing ship owners, at last consulted with Dr. Kirk and Mr. Parker as to the advisability of having the triple-expansion engine in their first steamer, and ultimately Dr. Kirk's firm (Messrs. R. Napier & Sons) were favoured with the order to build the now well-known steamer *Aberdeen*, which gave so much satisfaction that soon two others were built, viz., the *Australasian* and *Damascus*, and I consider great praise is due to Mr. Cornelius Thompson for the confidence reposed in these gentlemen, contributing so materially to the advancement and development of the marine engine. Of course it is useless for me to say that from the time the *Aberdeen's* results became known the triple-expansion principle became general. To all practical engineers it became apparent that the boilers under a working pressure of 150 lbs. and upwards would be a source of anxiety and trouble, and indeed this to a very large extent has been verified, inasmuch as the furnaces of the marine boilers under these heavy pressures have indicated weakness, and in hundreds of cases given much trouble. This difficulty is being overcome to a great extent, by supplying vessels with a fresh-water feed supply, which is a simple machine, but, in my opinion, invaluable to the safe working of the marine boiler at these high pressures. Moreover, the performances of the triple engines depend on our sea-going engineers, as much more is required of them now in order to cope with 150 to 200 lbs. of steam to the square inch. I think very great credit indeed is due to our sea-going engineers, seeing how rapidly pressures have increased, and how well they handle the various improved machines entrusted to their charge, including refrigerating, electric lighting, ventilating, pumping, forced draught, and a host of other inventions requiring watchfulness and skill, and without which the marine engine of the day would not be perfect. All have to be understood, worked, and kept in working order by the engineer. I am sure of one thing, and that is, that engineers of our great Mercantile Marine are becoming more valuable and important every year to the travelling public, and to the whole community.

I might continue this paper for hours by comparisons and results of various vessels, but I must content myself with giving you a few dimensions and particulars of one or two only.

I related that in 1788 the first steamboat had cylinders 4 in. diameter, and in 1838 the *Sirius* and *Great Western* crossed the Atlantic. I have nothing to guide me as to the number of days they did it in; but the piston speed of the *Great Western* was about 210 ft. per minute. The *Great Britain* crossed to New York in fifteen days on her first trip, burning about 7 lbs. of coal per I.H.P. per hour. The first triple vessel, the s.s. *Aberdeen* (not taking into consideration the *Propontis*), 3,600 tons, and 2,000 I.H.P., burned about 1¼ lbs. of coal per I.H.P. per hour.

But the first regular Atlantic liners I know of with triple engines are the *City of New York*, her sister ship, the *City of Paris*, and now, the *Teutonic*, all twin-screws. One can hardly imagine all the fine Atlantic liners being compound, except the last three named, and this shows how slow many are to take up the triple-expansion principle. The dimensions of the *City of New York* and the *City of Paris* are 560 ft. over all in length, 63¼ ft. beam, and about 35 ft. deep. Cylinders, 45 in. H.P., 71 in. Int., and 113 in. L.P. by 60 in. stroke; piston speed 850 to 900 ft. Nine boilers containing 54 furnaces about 3 ft. 11 in. diameter. 150 lbs. of steam; indicating about 18,000 H P, with closed stoke-holds; built by J. & G. Thomson, of Glasgow, to whom they are a great credit, inasmuch as they are making rapid and regular passages. The *Teutonic*, of the White Star Line, made the fastest maiden passage across to New York on record. Her dimensions are similar to the Inman Liners, she has twin screws, worked with or without forced draught, and her boilers arranged differently from the others; her machinery about the same dimensions, and although as yet she has not quite come up to the time of the *City of Paris*, she is expected to do so. The *Majestic*, building at Harland & Wolff's, is expected to be on the trade at an early date, and is a sister vessel to the *Teutonic*. The engine-room staff of each of these vessels being about 143 hands. The ship-owners of Liverpool deserve the greatest praise in building these floating palaces for the comfort of the travelling public, and let us hope they will be remunerated for their pluck, as well as for the great anxiety such undertakings naturally bring.

STOCKLESS ANCHORS FOR MEN-OF-WAR.—Mr. Wasteneys Smith, Newcastle-on-Tyne, has just received an order from a foreign government, who have already had his patent stockless anchors in use for some years, for a set of four bower anchors weighing about three tons apiece for an armed cruiser now building. These anchors will be arranged to stow up the vessels hawse pipes, obviating all catting and fishing and exposure of men to fire.

IN connection with the Thornycroft water-tube boiler it is interesting to note that glass-gauge tubes have been found unsuitable for the high pressure (250 lb. per square inch), which has been adopted with some of the most recent of these boilers. Up to 200 lb. per square inch no difficulty is found in using glass, but the addition of another 50 lb. seems to overtax this material. The difficulty has been got over by using talc, as Mr. Perkins had previously done with his high-pressure steam generator.

NEW STEAM YACHT.—An order to build a 350-ton steel steam yacht has been placed with Messrs. Ramage & Ferguson, Leith, by Mr. Harry Taylor, late owner of the well-known schooners *Bluebell* and *Hildegarde*. The new vessel, which will be designed by the builders, is to be 22 ft. beam with greater depth than usual, and is to be propelled by triple-expansion engines having cylinders 15¼ in. by 25 in., and 40 in. diameter by 27 in. stroke, all adapted for a very high rate of speed. The owner's accommodation is chiefly forward, and will be fitted up in the builders' best style, while all the latest improvements will be introduced. Besides this steam yacht Messrs. Ramage & Ferguson are laying down one of 600 tons, and are at present planking up the large 850-ton auxiliary now on the stocks.

AT the Board of Trade examination of marine engineers held at North Shields from the 8th to 12th inst., Mr. A. N. Peacock, of Sunderland, successfully passed his examination as *extra* first-class engineer. This gentleman is the only successful candidate throughout the kingdom, and in addition passed the first time of going up. He was prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields, and makes the thirteenth successful pupil in the above grade from this school.

AT a recent meeting of the Society of Chemical Industry Mr. Boverton Redwood read a paper on "The Petroleum Fields of India," from which it appears that the most abundant supply of oil is obtained from the wells at Khatan, in Beloochistan, where five wells have been drilled, each of which is capable of yielding upwards of 50,000 barrels per annum.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Landsdowne Tower.—On March 20th Messrs. William Dobson & Co. launched from their shipbuilding yard at Low Walker, a steel screw steamer, built to the order of Messrs. F. Stumore & Co., of London, for their Tower Line of steamers. The vessel is 327 ft. in length; 40 ft. 3 in. beam, and 29 ft. 5 in. deep, and is capable of carrying 4,500 tons deadweight. She was named the *Landsdowne Tower*. The Wallsend Slipway and Engineering Co. will supply the engines and boilers.

Trinidad.—On March 21st there was launched from the yard of Messrs. John Blumer & Co., North Dock, Sunderland, the steel screw steamer *Trinidad*, built to the order of the Trinidad Steamship Co., Limited, London. Her principal dimensions are :—Length, between perpendiculars, 240 ft.; beam, 34 ft.; depth moulded, 18 in., 30 in., and 49 in. diameter, having a stroke of 33 in.

Novorissisk.—On March 22nd Messrs. Newall & Co. launched from their yard, St. Philip's Ironworks, Bristol, a steel-built tug and salvage steamer, to class 100 A1 at Lloyd's. The vessel was named the *Novorissisk*. The builders are fitting her with compound engines of 300 I.H.P. She is intended for service in the Black Sea, the owners being the Vladikawkas Railway Co., St. Petersburg.

Prince Ja Ja.—On March 22nd there was launched from the shipbuilding yard of Messrs. William Thomas & Sons a steamer, 140 ft. long, named the *Prince Ja Ja*. The vessel, which has been constructed entirely of steel, has been built to the order of Messrs. Richards, Mills & Co., of Liverpool, and is to ply between Carnarvon and Liverpool. Immediately after the launch she was towed to Carnarvon, where she is to be fitted with engines by Messrs. De Winton & Co.

Ragnvald Jarl.—On March 22nd Messrs. Wigham, Richardson & Co. launched from their Neptune shipyard a steel screw passenger steamer, built to the order of the Nordenfjeldske Dampskibs-Selskab, of Throndhjem, and intended for the mail and tourist service between the Tyne and Norway. Her dimensions are 233 ft. by 30 ft. by 16 ft. 7½in. Her engines are also being constructed by the same firm, and are on the triple-expansion principle. She was named the *Ragnvald Jarl*.

British Queen.—On March 22nd there was launched from the yard of Messrs. Palmer's Shipbuilding and Iron Co., Jarrow, a large screw steamer of the following dimensions :—Length, between perpendiculars, 400 ft.; breadth, moulded, 47 ft.; depth, moulded, 30 ft. 7½ in. The vessel has been built under special survey to class 100 A at Lloyd's, and is of the three-deck type. A cellular double bottom for water ballast is fitted all fore and aft. Shifting boards and grain hatches in 'tween decks are fitted, suitable for carrying grain. The 'tween deck is provided for side lights, and special arrangements have been made for ventilation, &c., suitable for the cattle trade. The vessel is fitted with Clarke, Chapman's direct steam double capstan windlass, and Maginnis's patent steam steering gear aft. The vessel will have a deadweight carrying capacity of 6,600 tons, and has been built to the order of the British Shipowners' Co., under the inspection of Mr. W. Grundy. She was named the *British Queen* by Miss Price, daughter of the general manager of Palmer's Co.

Newby.—On March 22nd Messrs. Ropner & Son launched from their North Shore shipyard, at Stockton, a steel screw steamer, built to the order of Messrs. R. Ropner & Co., of West Hartlepool. Her dimensions are :—Length over all, 282 ft. 6 in.; breadth, 38 ft. 10 in.; depth, moulded, 21 ft 11 in. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 900 I.H.P., and two steel boilers working at 160 lbs. She was named the *Newby*.

Matteo Premuda.—On March 24th Messrs. the Blyth Shipbuilding Co., Limited, launched from their building yard, at Blyth, a fine steel cargo steamer. This vessel, which has been built on Austrian account, through Messrs. Potter Brothers, of London, is 228 ft. long by 32 ft. broad, and 16 ft. 4 in. deep, and has been constructed to Lloyd's highest class on the cellular bottom principle for water ballast. Her deck arrangements consist of a long raised quarter-deck and bridge. There are powerful steam winches to each cargo hold for the rapid loading and discharging of cargo, patent windlass on forecastle deck for working the anchors, and the steering arrangements consist of a compact hand and steam steering gear, fitted up in wheelhouse on bridge. The engines are of the triple-expansion type, with cylinders 16½ in., 26½ in., and 43½ in. by 33 in. stroke, and 150 lbs. ordinary working pressure, and will be supplied by the North-Eastern Engineering Co., Limited, of Wallsend-on-Tyne. As the vessel left the ways she was gracefully named the *Matteo Premuda* by Miss Vaughan, daughter of Mr. W. S. Vaughan, chairman of the Blyth Shipbuilding Co., Limited. The ship and engines have been constructed under the supervision of Mr. D. Meiklereid, M.I.N.A., of London, and the commander of the steamer is Captain Premuda. In addition to shipbuilding, the Blyth Shipbuilding Co., Limited, are extensive ship and engine repairers, and to more fully develop this branch of business they have constructed a graving dock, capable of docking vessels up to 350 ft. in length. This dock will be opened in a few weeks.

Siam.—On March 24th Messrs. J. Priestman & Co. launched from their shipbuilding yard, at Southwick, an awning-decked steamer of the following dimensions :—Length, 258 ft. ex.; breadth, 36 ft.; depth, moulded, 22 ft. 10 in. She is being fitted with triple-expansion engines by Messrs. Hutson, Corbett & Co., Glasgow, and was named the *Siam*. She has been built to the order of Messrs. Russel & Spence, of Glasgow, for their client, Tan Kinching, Siamese Consul-General, Singapore.

Irene.—On March 25th there was launched from Palmer's Jarrow yard a fine twin-screw steel yacht for the Honourable Corporation of the Trinity House, London, of the following dimensions, viz:—Length, between perpendiculars, 224 ft.; breadth, moulded, 27 ft.; depth, moulded, 14 ft. 1 in. The main deck is of teak and flush all fore and aft. The engines are placed about 'midships. The dining saloon, state rooms, &c., are fitted up below the main deck aft; and the accommodation for the officers, engineers, and crew below main deck forward. A large teak deck-house is fitted on the main deck aft, containing entrance to the after cabins. The cabins for the accommodation of the Trinity Brethren will be fitted out in a costly and luxurious style, including all the latest and most modern improvements. The vessel was christened *Irene*.

Ruskin.—On March 27th Messrs. Raylton, Dixon & Co. launched from their Cleveland dockyard a fine steel screw steamer, which has been built for Messrs. Arthur Holland & Co., London. This vessel is built on the raised quarter-deck principle, having a poop aft and a continuous bridge deck, forming a partial awning deck, her chief dimensions being :—Length, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight capacity of over 3,600 tons. She has three state rooms for passengers, saloon, &c., in poop aft, being otherwise fitted as a first-class cargo boat. Her engines will be supplied by Messrs. Thos. Richardson & Sons, Hartlepool, on their triple-expansion principle, with cylinders 22 in., 35 in., and 59 in. by 39 in. stroke, and fitted with patent horizontal steam windlass by Emerson, Walker & Co. On leaving the ways the vessel was christened *Ruskin*.

Arundo.—On April 2nd there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel screw steamer—length, over all, 274 ft.; 37 ft.; 19 ft. 9 in., moulded—built to the order of Messrs. Hudig & Veder, of Rotterdam. The vessel has been built under special survey, classed 100 A1 at Lloyd's, and on what is known as the builders' improved well deck type, with full poop, raised quarter-deck, long bridge-house, break forward and topgallant forecastle, and in her construction are introduced all the latest modern improvements. The engines will be by Messrs. Alley & McLellan, of Glasgow, and 1,000 I.H.P. The vessel has been built under the superintendence of Captain Pinkney, of Sunderland, and was named *Arundo* by Miss Edith Pinkney.

Fulham.—On April 5th Messrs. W. Gray & Co., Limited, West Hartlepool, launched the twelfth steamer they have built for Messrs. Watts, Ward & Co., of London. The new vessel is built of Siemens-Martin mild steel, and is of the following dimensions, viz.:—Length, over all, 280 ft.; breadth, 36 ft. 6 in.; and depth, 21 ft. 6½ in.; and over 3,000 tons deadweight capacity. She will take Lloyd's highest class, and is built on the web-frame and intercostal stringer system, dispensing with hold beams and giving a clear hold for stowing bulky goods. The deck erections consist of a poop with a handsome saloon and cabins, and raised quarter-deck, long bridge to fore hatch, and topgallant forecastle with accommodation for crew, The outfit and equipment consist of all modern appliances for a first-class cargo steamer of her size, including patent direct steam windlass, four steam winches, hand and steam steering gear amidships, screw steering gear aft, two donkey boilers, large hatchway, boats on beams overhead, and cellular double bottom throughout for water ballast. The rig will be schooner with double foretopsail and topgallant sail. Triple-expansion engines working on three cranks, to develop 800 H.P., and two steel boilers, to supply steam at a working pressure of 154 lbs. per square inch are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, and she is fitted with horizontal direct acting windlass by Emerson, Walker and Co. She was gracefully christened *Fulham* by Miss Marianne Emley, of Ellison Place, Newcastle-on-Tyne. The hull and machinery have been superintended during construction by Captain J. A. Hodgson and Mr. A. H. Alchin respectively, on behalf of the owners.

Federal.—On April 5th this vessel was successfully launched from the yard of Messrs. W. Doxford & Sons, at Pallion. She has been built to the order of John McIlwraith, Esq., of Melbourne, is entirely of steel, and to Lloyd's 100 A1 class. The principal dimensions are:—Length, between perpendiculars, 290 ft.; breadth, extreme, 40 ft.; depth, moulded, 22 ft.; with cellular bottom fore and aft, giving 3,425 tons dead-weight, or 20 ft. draft. The engines are triple-expansion three-crank, with all Messrs. Doxford's latest improvements, the cylinders being 23 in., 37 in., and 60 in. by 42 in. stroke, and are supplied with high-pressure steam from exceptionally large boilers capable of driving the vessel 11 knots loaded. She is fitted with steering gear amidships by Amos & Smith, of Hull, four steam winches with special coal drums by Welford Bros., of Pallion, and is also fitted with five special steam whips by Brown Bros., of Edinburgh, for quick discharge of coal cargo. She is also fitted with steam windlass on forecastle; she is fitted throughout with electric light, including three large arc lamps for cargo purposes. The cabins are in poop aft, with large entrance house and poop deck, the crew and firemen being in fore end of bridge. The christening ceremony was gracefully performed by Miss McIlwraith, of Melbourne.

Dorunda.—On April 5th Messrs. Steward & Latham, shipbuilders and engineers, South Dock Ironworks, Blackwall, London, launched the s.s. *Dorunda*, a very powerful steam tug, for service on the River Thames and elsewhere. She is 90 ft. long, 19 ft. beam, 11 ft. deep, and fitted with compound surface condensing engines (having an extraordinary large boiler) of about 350 H.P. by Messrs. Ross & Duncan, Govan, Glasgow, being supplied with one of their celebrated patent propellers—a style of screw which Messrs. Steward & Latham have frequently adopted with the most satisfactory results. The vessel is constructed to Lloyd's highest class, with a scantling considerably in excess of the rules, and under the Board of Trade's strict supervision, with the view to a passenger certificate. She has on board all the latest improvements, such as steam windlass, steering gear, gangways, &c. Her design includes a large iron bridge amidships, where she will be navigated from. The houses and deck erections are all of the richest teak and massive brass mountings. Altogether she is a particularly fine specimen of her type. She is built to the order of the Gravesend United Steam Towing Co., and will be commanded by Captain J. W. Hayward, so well known and popularly esteemed on the Thames. As she commenced to glide she was gracefully christened in the usual way by Miss Alice Smith, of Gravesend, eldest daughter of one of the shareholders.

Ingleby.—On April 5th Messrs. R. Craggs & Sons, Middlesbro'-on-Tees, launched a steel screw steamer, the *Ingleby*, built to the order of the s.s. Ingleby Co., particulars of which are as follows:—Length, 270 ft.; breadth, 36 ft. 6 in.; depth moulded, 19 ft. She is of the partial awning deck type, with accommodation in short poop aft. She is fitted with every requisite of the most modern type of cargo boat for rapid loading and discharging, patent windlass by Emerson, Walker & Co., &c., including large horizontal donkey boiler. Her engines will be fitted by Messrs. Westgarth, English & Co., of the same port, and have cylinders 20 in., 33 in., 54 in. diameter, by 36 in. stroke, and steam is supplied from two extra large steel boilers. The hull has been constructed under the superintendence of Captain Oswald Andrews, and the machinery under the inspection of Mr. James Summers, both of Middlesbro'.

E. S. Lancaster.—On April 5th Messrs. Thomas & William Smith launched from their shipbuilding yard, at North Shields, an iron screw steamer to the order of Messrs. Lancaster, Speir & Co., Newport (Mon.), of the following dimensions:—Length, 165 ft. by 25 ft. by 13 ft. 6 in., to carry 750 tons deadweight. She will be fitted with triple-expansion engines, cylinders 13¼ in., 22 in., 36 in. by 24 in. stroke; boiler 160 lbs. pressure, supplied by Messrs. J. P. Rennoldson & Son, South Shields. The vessel was named *E. S. Lancaster*.

Gorgon.—On April 9th Messrs. W. H. Potter & Sons launched from their shipbuilding yard an iron screw steamer, of which the following are the outline particulars:—Length, 234 ft.; breadth, 34 ft.; depth of hold, 15 ft. 8 in.; net register, about 880 tons. The vessel, which was named *Gorgon*, has been built to the order of Mr. Alfred Holt, of Liverpool. Messrs. Fawcett, Preston & Co., Limited, have made the engines—the cylinders being 21¼ in. and 46 in. by 36 in. stroke.

Gaelic and Hellenic.—On April 10th Messrs. Earle's Shipbuilding & Engineering Co., Hull, made a further addition to the fleet of the Grimsby Steam Fishing Co., Limited, by launching two fine steam trawling vessels, 100 ft. long by 20 ft., 6 in. beam, by 10 ft. 9 in. depth of hold, built of iron to Lloyd's 100 A class with such special excesses of scantlings as have been found desirable by experience. They have half forecastle forward, a raised quarter-deck aft, accommodation for captain, mate, and engineers in cabin aft, and for the crew in the forecastle. These ships will be dandy-rigged, and they will be fitted with patent windlass, a 6 in. by 10 in. special steam trawl winch, trawl ports, and rollers on both sides, steering gear on raised platform amidships the usual provision of bollards, hawse pipes, pumps, &c., and the holds will be fitted up in the latest and best style for the stowage and handling of fish and ice. The machinery consists of a set of triple compound three-crank engines with cylinders 12¾ in., 20 in., and 32 in. diameter by 22 in. stroke, and a large size steel boiler to work at 150 lbs. pressure. The vessels were named respectively *Gallic* and *Hellenic*.

Bear Creek.—On April 10th Messrs. Sir W. G Armstrong, Mitchell & Co. launched from their Walker shipbuilding-yard a steel screw steamer named *Bear Creek*, which has been built to the order of the Bear Creak Oil and Shipping Co. The vessel has been specially constructed for the carriage of petroleum in bulk, and is built to the highest class Bureau Veritas. She is capable of carrying about 3,500 tons.

Austria.—On April 10th there was launched from the shipbuilding-yard of Messrs. S. P. Austin & Son, Sunderland, a screw steamer named *Austria*, of about 2,200 tons gross register, constructed throughout of steel, and under special survey at Lloyd's, to class 100 A. She will be fitted with triple-expansion machinery by Messrs. Blair & Co., Limited, of Stockton-on-Tees.

Torquay.—On April 17th there was successfully launched from the yard of Messrs. R. Thompson & Son, Southwick, an iron screw steamer, built to the order of Messrs. Whiteway & Ball, of Torquay. The dimensions are—length, 180 ft breadth, 29 ft.; depth, 13 ft. 9 in.; built under special survey, and classed 100 A1 at Lloyd's. She is of the raised quarter-deck type, with bridge and top gallant forecastle, having water ballast fore and after holds and peaks, also large hatchways worked by specially designed powerful steam winches, and donkey boiler. The captain and officers are berthed in the front of the bridge, and the engineers at after end of same, the forecastle being fitted up to accommodate the crew and firemen. The vessel is fitted with all the latest improvements, including steam-steering gear, direct steam windlass, gangways to hatches, &c. The engines, by Messrs. G. Clark, Limited, Southwick, are triple-compound, having cylinders 15½ in., 25 in., and 41 in. by 27 in. stroke, with large boilers. The vessel has been constructed under the personal supervision of Mr. Evans. As the steamer left the ways she was gracefully named the *Torquay* by Miss Ball, of Torquay.

Tandil.—On April 17th Messrs. Raylton, Dixon & Co. launched from their Cleveland dockyard a steel screw steamer, which has been built to the order of Messrs. Arthur Holland & Co., London. The vessel is of the following dimensions:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; with a deadweight capacity of about 3,300 tons. She is built on the web-frame principle, having poop, raised quarter-deck, long bridge, topgallant forecastle, and fitted throughout as a first class cargo boat. Her engines will be supplied by the North-Eastern Marine Engineering Co., Sunderland, with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, and she is fitted with Emerson, Walker & Co.'s patent horizontal steam windlass. On leaving the ways the vessel was christened *Tandil*.

Gleneden.—On April 17th there was launched from the shipbuilding-yard of Messrs. John Priestman & Co., Southwick, Sunderland, a screw steamer of the following dimensions:—Length, 240 ft.; breadth, 32 ft.; depth, moulded, 16 ft. 7 in. She has been built to the order of Messrs. R. Livingstone & Co., West Hartlepool, and is to have the highest class at Lloyd's. The engines, which are of the triple-expansion type, have been built by Messrs. William Allan & Co., Scotia Engine Works, Sunderland, and are of about 550 I.H.P. The vessel was named the *Gleneden*.

Gulf of Ancna.—On April 18th Messrs. R. & W. Hawthorn, Leslie & Co., Limited, launched from their shipyard, at Hebburn, a steel screw steamer from the Greenock Steam Shipping Co.'s "Gulf" Line. The dimensions of the new vessel are as follow:—Length, 314 ft.; breadth, 42 ft.; depth, 26 ft. 6 in. She was named the *Gulf of Ancna*.

Girdleness.—On Saturday, April 19th, Messrs. Richardson, Duck & Co. launched from their building yard, at South Stockton, a steel screw steamer of the following dimensions, viz.: Length, between perpendiculars, 270 ft.; breadth, extreme, 37 ft.; depth, moulded, 19 ft. 5 in.; tonnage gross, about 1,900 tons. The vessel, which has been built to the order of Messrs. Farrar, Groves & Co., of London, will be classed 100 A1 at Lloyd's. She has a raised quarter-deck, a long bridge, extending to stern, and a double bottom on the cellular principle, extending fore and aft, for water ballast. She will be fitted with a cestus donkey boiler, four steam winches, steam steering gear, stockless anchors, and all the latest improvements for facilitating loading, discharging and manœuvring the vessel. Her engines by Messrs. Blair & Co., Limited, have cylinders 21 in., 34 in. and 56 in. by 36 in. stroke. As the vessel was leaving the ways she was gracefully christened *Girdleness* by Miss Marsh, Glen Lyon, County Down.

Dolores.—On Saturday afternoon, April 19th, Messrs. Raylton, Dixon & Co. launched from their No. 2 Dockyard, Middlesbro', a steel screw steamer of the following dimensions:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; with a deadweight capacity of about 3,300 tons, which has been built to the order of Messrs. Arthur Holland & Co., London. She is built on the web-frame principle, having poop, raised quarter-deck, long bridge, and topgallant forecastle, and is generally fitted as a first class cargo boat. Her engines will be supplied by Messrs. the North-Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 21 in., 35 in., 57 in. by 39 in. stroke. On leaving the ways the boat was named *Dolores*. This vessel is a sister ship to the steamer *Tandil*, launched on the 17th inst.; and also to the steamer *Lomas*, launched March 13th.

Manuka.—On Saturday, April 19th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer, which has been built to the order of Messrs. Thomas Stephens & Sons, of London. She is of the following dimensions, viz.:—Length, 260 ft.; breadth, 36 ft. 8 in.; depth, 19 ft. 3 in., and is built under Lloyd's special survey to class 100 A1 on the partial awning deck rule. This steamer has water ballast right fore and aft, on the cellular system, and is fitted with all modern improvements for the rapid loading and discharging of cargo, including large donkey boiler and four double-cylindered steam winches, and has direct-acting steam windlass, steam steering gear by Messrs. Davis & Co., of London, and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. the Wallsend Slipway and Engineering Co., Limited, are of the triple-expansion type, having cylinders 20 in., 34 in., and 54 in. by 36 in. stroke, with two large boilers, working at 160 lbs. pressure. On leaving the ways the vessel was gracefully named the *Manuka* by Mrs. Bovey, wife of Captain Bovey.

Tellus.—On April 19th this steamer, the largest yet owned in Norway, was successfully launched by Messrs. Osborne, Graham & Co. from their yard, at Hylton, near Sunderland, her dimensions being 302 ft. by 40 ft. by 23 ft. 1½ in. She has been built of steel under special survey to take Lloyd's highest class, and has short full poop, raised quarter-deck, long bridge, and topgallant forecastle, having a very short well, web frames, and cellular double bottom for water ballast fore and aft. She will be fitted up with the latest improvements for rapid loading and discharging and safe navigation, including full complement of steam winches by Clarke, Chapman & Co., large donkey boiler, Sir William Thomson's compass, steam steering gear, direct steam windlass, &c. She will be supplied with tri-compound engines by Messrs. George Clark, Limited, of Southwick, Sunderland, having cylinders 22½ in. by 37 in. by 61 in. in diameter with 42 in. stroke, and two large boilers. The vessel has been sold to Mr. Wilhelmsen, of Tonsberg, Norway, and will carry about 4,000 tons deadweight, with Lloyd's summer freeboard. On leaving the ways the steamer was named the *Tellus*, of Tonsberg, by Madame Petersen.

Hanna Heye.—On April 19th there was launched from the shipbuilding yard of Messrs. W. Pickersgill & Sons, of Sunderland, a very handsome iron bark of 1,360 tons, net register, 100 A1 at Lloyd's; to the order of Carl Neynaber, Esq., of Germany, to be commanded by Captain Warns, and intended for the nitrate trade. She has an iron 'tween deck fore and aft, besides all the latest improvements. Miss Laura Holmes, of London, niece to Captain C. H. Newman, gracefully named her the *Hanna Heye*.

Inverna.—On April 19th a considerable amount of interest was shown in the launch of the new cutter *Inverna*, which took place at Southampton in the presence of a very large company. She was designed last year by Mr. Alexander Richardson, of Liverpool, for Mr. John Jameson, of Dublin, and has been built by Messrs. Fay & Co., of Northam, Southampton, in about four months from the time of laying down. It may be said that speed has been the first consideration in the *Inverna's* design, and, in order that no possible advantage might be lost, the vessel has been built to carry a centre-board, and she will be canvassed up to the last thread it would be desirable to give a yacht of her dimensions for a racing round of the British regatta courses. She is quite a departure in model from the *Irex* and the more modern *Yarana* and *Valkyrie*, and altogether different in mould to the *Thistle*. She has a large body, but a moderate wetted surface withal, yet has not been stinted in gripe forward, and, with great depth aft, does not look like a vessel that would require a centre-board to hold her to windward. The greatest draught of water will be at the heel of the lead keel, and the excessive rake of the stern-post arrests attention. The rudder is limited in area, and the main piece butts in over the top of the lead keel. The main cabin fittings are in carved pine, and the rest in Hungarian ash and American walnut. The principal dimensions of the vessel and the measurement of spars are as follows:—Length on water-line, 84 ft.; breadth, extreme, 19 ft.; length over all, 110 ft.; draught of water, 13½ ft.; draught of water, with centre-board down, 21 ft.; angle of rake of stern-post, 60 deg.; weight of lead keel, 71 tons 13 cwt.; length of mast, deck to hounds, 56 ft.; length of bowsprit outboard, 34 ft.; length of mainboom, 77 ft.; length of gaff, 49 ft.; length of topmast, 47 ft.; length of spinnaker boom, 68 ft.; length of working topsail yard, 44 ft.; sail area, about 8,300 square feet; rating by Yacht Racing Association measurement, 115. She has been built under the supervision of her master, Mr. W. O'Neill, and will have a crew of 17 all told.

Mayfield.—On April 19th the Bute Shipbuilding, Engineering, & Dry Dock Co., Limited, launched from their shipbuilding yard, Cardiff, a fine screw steamer, built to the order of Messrs. Frederick Woods & Co., of London, and intended for the East India and general trade. The vessel is of the following dimensions:—Length, over all, 310 ft.; beam, 38 ft. 6 in.; depth, moulded, 23 ft. 3 in.; deadweight about 3,850 tons. She is built of steel manufactured by the Dowlais Iron Co., at their Dowlais Works, and the work of construction has been under the supervision of Captain Fleming. The engines are of the triple-expansion type, the cylinders being 23 in., 36½ in., and 62 in., with 39 in. stroke. Steam is generated in two boilers of 12 ft. 9 in. diameter and 11 ft. long, working to a pressure of 160 lbs. to the square inch. The engines have been constructed under the supervision of Messrs. Charles Sage & Sons, consulting engineers. Mr. Thomas Dobson, manager for the Bute Shipbuilding Co., has had the entire general management.

Kabyle.—On April 19th Messrs. Wigham, Richardson & Co. launched from their Neptune Shipyard a finely-modelled steel screw steamer, designed for a service speed of 13 knots, and built to the order of the Campagnie Anonyme de Navigation Mixte, of Marseilles, being the fifth steamer built for that company by Messrs. Richardson & Co., and they have further work for them on hand. She is 260 ft. long, 32 ft. beam, and 25 ft. deep, and is fitted up with accommodation of a most elegant description for first, second, and third-class passengers in the service between Marseilles and Algiers, for which she is destined. The engines are on the triple-expansion principle, and are also being supplied by Messrs. Wigham, Richardson & Co. As the vessel left the ways she was named the *Kabyle*.

Prodano.—Monday afternoon, April 21st, was the occasion chosen for the launching of a large and handsomely modelled clipper stem-screw steamer from the building yard of the Blyth Shipbuilding Co., Limited, at Blyth. This vessel has been built for the Pinkney & Sons Steam Ship Co., Limited, of Sunderland. Her leading dimensions are as follows:—Length, 326 ft.; breadth, 40 ft.; and depth, 27 ft. 9 in. The vessel is built principally of steel, and has cellular double bottom for water ballast throughout, and is fitted with web frames, thus dispensing with hold beams and allowing cargoes of the bulkiest description to be easily stowed. The passengers' and captain's state rooms and saloons are fitted in a large house aft, and will be completed in a handsome manner. The engineers and officers are accommodated in a house on deck amidships, and the crew's berths are provided for in the top-gallant forecastle. The vessel is fitted with all the latest improvements for the rapid loading and discharging of cargo. Emerson, Walker & Co.'s patent direct-acting steam windlass is placed on forecastle deck for working the patent stockless anchors, whilst Harrison's steam steering gear is fitted amidships, and a powerful screw-gear is placed aft. The spar-deck of the vessel is sheathed with wood and the main deck is of steel. The engines for this vessel are being made by the North-Eastern Engineering Co., Limited, of Sunderland, and will be placed on board immediately. The owners' representatives, Messrs. T. Collin and J. Brock have superintended the work on the ship and engines. The vessel was gracefully christened the *Prodano* by Miss Pinkney, of Sunderland. After the launch the company adjourned to the builders' offices, where the usual toasts were proposed.

Therese Heymann.—On April 21st Messrs. Ropner & Son launched from their North Shore Shipyard, at Stockton, a steel screw steamer, built to the order of Messrs. M'Nabb, Rougier & Co., of Odessa. Her dimensions are as follows:—Length, over all, 302 ft.; breadth, 39 ft.; and depth moulded, 22 ft. 6 in. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 1,000 I.H.P., and two large steel boilers working at 160 lbs. She was named *Therese Heymann*.

Calcutta City.—On Tuesday, April 22nd, Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length, over all, 300 ft.; breadth, 38 ft.; depth, 22 ft. 2 in.; built to the order of Christopher Furness, Esq., West Hartlepool. She will class 100 A1 at Lloyd's, and has large internal and deadweight capacities. Her deck erections consist of a poop, raised quarter-deck, long-bridge of extra strength and open topgallant forecastle. A handsome saloon and state rooms for the captain, officers, and a few passengers will be fitted up aft, the engineers' rooms will be in the after part of the bridge and the crew's berths in the fore part of same. The hull is built on the web-frame system and gives clear holds for stowing cargo of the bulkiest description. Large hatchways are fitted, four steam winches, steam steering gear amidships, and screw gear aft, Emerson, Walker & Co.'s patent windlass, large donkey boiler and double bottom under each hold for water ballast. The boats will be carried on beams overhead, and the vessel in every respect thoroughly equipped for general trading. First-class engines on the three-cylinder triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, working on three cranks they will develop over 950 H.P. The cylinders are 21½ in., 35 in., and 58 in. diameter, with a piston stroke of 39 in., and a constant supply of steam at a working pressure of 150 lbs. per square inch will be maintained by fine large steel boilers. The vessel was gracefully christened *Calcutta City* by Miss Furness, niece of the owner. The hull and machinery have been constructed under the superintendence of Captain King and Mr. E. S. Booth respectively on behalf of the owner. This is the fifteenth vessel built for the same owners by Messrs. W. Gray & Co., Limited.

Espora.—On April 22nd Messrs. Laird Brothers, who have just now approaching completion two torpedo gun vessels which they are building to the order of the Government of the Argentine Confederation, launched the first of these vessels from the Birkenhead Ironworks, named the *Espora*, after one of Admiral Brown's most distinguished officers in the War of Independence. The ceremony was gracefully performed by Senora Garcia, wife of Captain Manuel José Garcia, of the Argentine Navy, who is now representing his Government in Europe in the torpedo branch of the service, and under whose supervision the vessels are being built. In addition to Captain Garcia there were present Captain F. Spurr and Captain Cabassa, of the Argentine Naval Commission, Captain Scott Brown, Captain Loqui, and Captain Betbeder, and other officers of the Argentine Navy, Captain A. Fernandez, of the Chilian Navy, and a large party of ladies and gentlemen. The *Espora* may be shortly described as being of the *Rattlesnake* type, but to have higher speed, lighter draught of water, and various structural improvements suggested by recent experience. Her length, over all, is 210 ft.; beam, 25 ft.; depth, 13 ft. 6 in.; tonnage, old measurement, 615 tons, and she will be fitted with twin-screws driven by two sets of triple-compound engines, having 3,250 H.P., and supplied with steam at 150 lbs. pressure by four steel boilers of the locomotive type. The hull is built entirely of steel, with ram stem, and is divided into upwards of 30 water-tight compartments, and the coal bunkers are arranged to afford protection to the machinery. Each set of engines and each pair of boilers are in separate compartments. The armament will consist of Nordenfeldt quick-firing guns, two 14-pounders mounted one on each side of the forecastle, each commanding a range across the bow, and 75 degrees abaft the beam on its own side. One 8-pounder at after end of poop, having a range from 65 degrees before the beam on one side to the same on the other side. Two 3-pounders at the fore end of the poop, each firing right aft and 70 degrees forward of beam, and two Gatling guns. Five torpedo tubes, one in bow and two on each broadside, fitted for discharging the new 18 in. Whitehead torpedo, these vessels being the first to be fitted with this improved missile.

LAUNCHES.—Scotch.

Vasna.—On March 22nd the Ailsa Shipbuilding Co. launched a steel screw steamer named the *Vasna* for the British Indian Steam Navigation Co., Limited, for their Indian coasting trade. Her dimensions are:—200 ft. by 29 ft. by 20 ft. to awning deck, and she is fitted with triple-expansion engines 17 in. 27 in., and 44 in. by 30 in. stroke, by Messrs. Dunsmuir & Jackson, of Govan. She will be fitted with steam windlass, steam steering gear, electric light throughout, and all the latest appliances.

Ethelred.—On March 24th Messrs. S. M'Knight & Co., shipbuilders, Ayr, launched a steel screw steamer named the *Ethelred* for the Macgregor Steamship Co., Limited, Glasgow (Messrs. Colvils, Lowdon & Co., managers), for the American fruit trade. Dimensions:—Length, between perpendiculars, 205 ft.; breadth, extreme, 28 ft.; depth of hold to awning deck, 21 ft. 8 in.; 900 tons gross register; built under special survey to class 100 A1 at Lloyd's, and to Board of Trade requirements for passenger certificate, with accommodation for passengers, engineers, and officers in a house on deck. The machinery, which is triple-expansion, will be fitted by Messrs. David Rowan & Son, Glasgow; cylinders, 18 in., 27 in., 45 in. diameter by 36 in. stroke; double-ended boiler, 17 ft. long by 13 ft. 6 in. diameter, 160 lbs. working pressure. The construction of the vessel and machinery has been carried on under the superintendence of Mr. James Smith, consulting engineer, Greenock and Glasgow.

Elmbank.—On March 26th Messrs. Russell & Co. launched from their Kingston shipbuilding-yard, Port Glasgow, a four-masted steel barque of 2,200 tons net register, to carry 3,600 tons on Lloyd's freeboard. Her dimensions are:—Length, 278 ft.; breadth, 42 ft.; and depth, 24 ft. 3 in. The new vessel has been built for Messrs. Andrew Weir & Co., Glasgow, and on leaving the ways was named the *Elmbank*.

Gulf of Lyons.—On March 28th Messrs. Caird & Co., Greenock, launched a steel screw steamer, named the *Gulf of Lyons*, for the Greenock Steamship Co., Limited, the dimensions of the vessel being as follows:—Length, between perpendiculars, 314 ft.; breadth, 42 ft.; depth, moulded, 26 ft. 6 in.; and of 2,630 tons gross. Her engines, of 2,000 I.H.P., are on the triple-expansion principle.

Cambria.—Messrs. Murray Brothers, Dumbarton, have launched from their yard an iron screw tug named the *Cambria*, 72 ft. by 14 ft. by 8 ft., for service in the Thames. The engines will be supplied by Messrs. Kincaird & Co., Limited, Greenock.

Hornby.—On April 2nd Messrs. S. McKnight & Co., Ayr, launched a screw tug of about 180 tons gross, named *Hornby*, built to the order of the Alexandra Towing Co., Limited, Liverpool. The vessel is 116 ft. long, 21 ft. beam, and 12 ft. deep. The propelling machinery has been constructed by Messrs. Ross & Duncan, Govan, and consists of two pairs of compound surface condensing engines, having cylinders 15 in. and 30 in. in diameter, with a 20 in. stroke. Steam is generated in two boilers 14 ft. in diameter and 10 ft. 6 in. long, working to a pressure of 100 lbs. to the square inch.

Ping Suey.—Messrs. Barclay, Curle & Co., Limited, have lately launched from their yard at Whiteinch, Glasgow, a steel screw steamer named *Ping Suey*, built by them to the order of the China Shippers' Mutual Steam Navigation Co., Limited, London, and intended for service between London and China. The vessel is of 3,150 tons gross, the dimensions being as follows:—Length, 365 ft.; breadth, 41 ft. 6 in.; depth, 28 ft. 3 in. The engines, which are of the triple-expansion type, have been constructed by the builders. The cylinders are 32 in., 49 in., and 77 in. in diameter respectively, with a 4 ft. stroke. Steam is generated in boilers 15 ft. 3 in. by 17 ft., and working to a pressure of 160 lbs. to the square inch. The tube surface is 6,800 square feet, the heating surface 7,460 square feet, while the grate area is 260 square feet. The condensing surface is 4,200 square feet. While developing about 2,800 I.H.P., it is expected the speed will be from 14 to 15 knots. She is fitted with Wasteneys Smith's patent stockless anchors stowing up hawse pipes.

Chicharra.—On April 2nd Messrs. Blackwood & Gordon, engineers and shipbuilders, Port-Glasgow, launched a steel sailing schooner of the following dimensions:—Length, 108 ft.; breadth, 27 ft. 6 in.; depth, 10 ft. 3 in., to carry 370 tons deadweight. On leaving the ways she was named *Chicharra* by Miss Purvis, daughter of one of the builders. This vessel is the first of two being built by Messrs. Blackwood & Gordon for Messrs. James & Alex. Allan, of Glasgow, for their River Plate coasting trade, and is being rigged to sail out.

Rotokine.—On April 3rd Messrs. William Denny & Brothers launched from their shipyard at Dumbarton the steel screw steamship *Rotokine*, of the following dimensions:—270 ft. by 37 ft. 6 in. by 21 ft. 9 in., and of about 2,000 tons gross register. She will be classed 100 A 1 at Lloyd's, and will be fitted with Brook's patent quadruple engines by Messrs. Denny & Co. The *Rotokine* has been built to the order of the Union Steamship Co., of New Zealand, Limited. She carries Wasteneys Smith's stockless anchors stowed up hawse pipes.

Brazilian.—On April 3rd there was launched from the yard of Messrs. D. & W. Henderson & Co., Partick, a large and handsomely modelled screw steamer, named the *Brazilian*, for Messrs. J. & A. Allan for their South American trade. The vessel has been built of Siemens-Martin steel to class 100 A1 three-deck rule. Her dimensions are 310 ft. by 41 ft. 9 in. by 28 ft. 3 in., with a gross tonnage of about 3,250 tons. In poop aft she has superior accommodation for a limited number of first-class passengers. Officers and engineers are berthed under the bridge deck, and seamen and firemen in topgallant forecastle. She has all the latest and most approved appliances for the rapid loading and discharge of cargo, including Napier Bros'. patent combined hand and steam steering gear and steam windlass. She will also have a complete installation of electric light, which is being fitted on board by Messrs. Paterson & Cooper. Her engines, constructed by the builders, are of the triple-expansion type—cylinders, 24 in., 40 in., and 66 in. in diameter, by 48 in. stroke.

Duchess of Fife.—On April 5th a new steamer, named the *Duchess of Fife*, was launched at Aberdeen from the shipbuilding-yard of Messrs. Hall, Russell & Co. The vessel has been built to the order of the Aberbeen Lime Co., and is intended for the coal trade. She is 197 ft. in length, 28 ft. 6 in. in breadth, and 15 ft. in depth, with carrying capacity of 700 tons gross. She is fitted with patent windlass by Emerson, Walker & Co., Limited.

Priam.—On April 5th Messrs. Scott & Co., shipbuilders, Greenock, launched from their yard, at Cartsdyke, a steel screw steamer of 2,800 tons register, for the Ocean Steamship Co., of Liverpool. Her dimensions are as follows:—Length, 335 ft.; breadth, 38 ft. 6 in.; and depth, 27 ft. The new steamer was named the *Priam*. She will be engined by the builders with compound tandem engines of 1,500 H.P.

Jaboatao.—On April 5th Messrs. A. Hall & Co. launched at Aberdeen a steamer, which has been built for the Companhia de Navigacao de Pernambuco, and is intended for the cargo trade on the coast of Brazil. She was named the *Jaboatao*, and is 200 ft. in length, 29 ft. in breadth, 11 ft. 6 in. in depth to main deck, and 750 tons gross.

Clyde.—On April 5th Messrs. R. Napier & Sons launched from their shipyard, at Govan, the last of the four steel screw steamers of about 5,650 tons each for the Royal Mail Steam Packet Co., London. These magnificent steamships have been specially designed to meet the requirements of the company's West Indian, Brazil, and River Plate service; and in order to attain a high rate of speed, with the greatest economy, the hulls have been constructed upon fine lines, and the machinery consists of powerful triple-expansion engines, of 7,000 I.H.P., and fitted with all the most modern improvements. The general dimensions of the vessel are:—Length, over all, 456 ft.; breadth, extreme, 50 ft.; depth to spar deck, 33·4 ft.; built of steel to class 100 A1 at Lloyd's under special survey, and to meet the Admiralty requirements as armed cruisers. The accommodation for the passengers is of the most luxurious description, and all the details have been carefully considered with special reference to a first-class service in a hot climate. To admit of perfect ventilation the dining saloon has been placed upon the upper deck before the machinery, where there is no vibration, and is so arranged that family parties can dine together at separate tables. The sides of the saloon are finished in polished walnut with exquisitely carved walnut panels from Florence, and the ends are fitted with artistically-designed sideboards, bookcases, glass racks, &c., with a handsome organ at the forward end. A double staircase, with walnut rails and carved balusters, leads to the music-room on the promenade deck, which is decorated in a lighter style, and is finished in bird's-eye maple and satinwood, and supplied with a fine piano. On the other side of the landing is a comfortable ladies' boudoir, finished in the same style as the music-room; and farther aft is the first-class smoking-room, fitted in polished mahogany and walnut. The promenade deck, upwards of 200 ft. in length, is entirely reserved for the first-class passengers, while the second-class have the poop for their own use. The accommodation for the latter is of a very superior description, but little inferior to the first-class, and comprises a handsome dining saloon, comfortable ladies' cabin, and smoking-room, with a separate suite of baths and lavatories. State rooms for about 200 first and 40 second-class are situated on the main deck; these are exceptionally large and airy, many of them being adapted for families, and are fitted with all the most recent improvements for the comfort and convenience of the passengers, such as patent iron bedsteads with spring wire bottoms, folding washstands, pneumatic bells, electric light, &c. A special feature is the width of the passages, which are also very well lighted, and the lavatory arrangements, with marble baths, &c., are of the most complete description. Superior accommodation has also been provided for 500 third-class passengers in the after part of the 'tween decks, with portable iron beds, &c. The comfort of the officers has had special consideration, their cabins being large and handsomely fitted; and the crew are berthed in a large and roomy forecastle. The pantry and galley arrangements are replete with every convenience to provide for 1,000 people, and refrigerating machinery and chambers have been fitted for a sufficient supply of fresh provisions during the whole voyage. It is worthy of note that the entire passenger accommodation is heated by steam, and that the electric light is fitted in every part of the ship. The most modern improvements have also been introduced for the rapid and noiseless handling of cargo and the efficient working of the ship, including Brown's hydraulic cargo gear, Chadburn's telegraphs, Sir William Thomson's compasses, steam windlass and steering gear, &c. Having been built with a handsome clipper bow and figurehead, the ship has a most symmetrical appearance, which will be enhanced by a smart rig, and altogether this magnificent vessel will be one of the most complete and artistically fitted passenger steamers afloat, and reflects great credit upon the enterprise of the Royal Mail Co., in adding four such splendid steamships to their fleet. The ship and machinery have been constructed under the supervision of Mr. Bowers, the company's superintending engineer, with Mr. Shelton as resident inspector, and when completed will be placed under the command of Captain Spooner. As the ship commenced to move down the ways she was named the *Clyde* by Lady Colville of Culross, and after the launch the vessel was towed up the harbour to receive her machinery, which has been constructed at the builder's Lancefield Engine Works.

Baracoa.—On April 7th Messrs. S. and H. Morton & Co., Leith, launched from their yard a steel screw steamer named the *Baracoa*, built to the order of Messrs Harloff & Boe, Bergen, and intended for the fruit trade between the West Indian Islands and the United States. The dimensions are :—Length, 180 ft.; breadth, 28 ft.; depth, 12 ft. 8 in. The engines will be triple-expansion, having cylinders 16 in., 26 in., and 40 in. diameter, with a stroke of 30 in., and a working pressure of 160 lbs. The steamer will be commanded by Captain Clausen. She is fitted with steam windlass, Emerson, Walker & Co.'s patent.

Brand.—On April 7th Messrs. Robert Duncan & Co., Port Glasgow, launched a steel screw steamer of 2,000 tons net register, and to carry 3,500 tons on Lloyd's freeboard. The vessel, which is named *Brand*, is of the following dimensions :—Length, 270 ft.; breadth, 37 ft.; and depth, 23 ft. The propelling machinery has been fitted on board by Messrs. Muir & Honston, Kenning Park, Glasgow, and consists of a set of triple-expansion engines having cylinders 21 in. 35 in., and 56 in. in diameter, respectively, and with a piston stroke of 39 in. Steam is generated in a boiler 14 ft. 3 in. in diameter and 11 ft. long, worked under forced draught on Howden's system.

White Heather.—On April 8th there was launched from the shipbuilding yard of Messrs. John Reid & Co. a large screw auxiliary yacht, named the *White Heather*. This vessel has been built for Mr. R. Cecil Leigh, who intends to use her for ocean cruising. She is 636 tons measurement, and will be barque-rigged. She will be fitted with triple-expansion engines.

Dnckenfield.—On April 8th Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched a steel twin-screw steamer, having dimensions 220 ft. by 31 ft. by 15 ft. 6 in. She is to be fitted with two sets of quadruple-expansion engines, to work with boiler pressure at 200 lbs., and 1,200 I.H.P. This vessel has been built to the order of Messrs. J. & A. Brown, New South Wales, for their colonial trade. She was named the *Duckenfield*.

George Dumoise.—On April 8th there was launched from the Killybank shipbuilding yard, Alloa, by the Grangemouth Dockyard Co., a steel screw steamer, named the *George Dumoise*. which has been built to the highest class of Norwegian Veritas, It has been built to the order of Mr. Camble, of Bergen, and is intended for the South American fruit trade. Her length is 180 ft. by 27 ft. 10 in. by 12 ft. 10 in.

Screw Steamer.—On April 8th there was launched from the Abercorn Shipbuilding Yard, Paisley, a steel awning-decked screw steamer, built and fitted up expressly for the fruit trade between the West Indies and New York. Dimensions :—185 ft. by 28 ft. by 19 ft. 10 in., built to Lloyd's highest class 100 A1. Engines, triple-expansion, of about 700 H.P., supplied by Messrs. Hanna, Donald & Wilson, Paisley. The owner of the vessel is Mr. Jacob Christensen, of Bergen.

Prince.—On April 8th Messrs. John Fullerton & Co., Merksworth Building Yard, Paisley, launched an iron screw steamer of about 400 tons gross, named the *Prince*, built for Messrs. J. & J. Hay, Renfield Street, Glasgow, and intended for their general coasting trade. The *Prince* will be towed to Glasgow to have the machinery put on board by Messrs. Muir & Houston, engineers.

Dumbarton Rock.—On April 9th Messrs. Russell & Co. launched from their Port-Glasgow East-end yard a three-masted steel sailing ship, named *Dumbarton Rock*, for Messrs. James Cornfoot & Co., Glasgow. Dimensions :—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft.; of 1,700 tons net register, to carry 2,800 tons deadweight cargo. She is fitted with Emerson, Walker & Co.'s patent capstan windlass.

Banda.—On April 9th Messrs. Charles Connell & Co. launched from their shipbuilding-yard, at Scotstoun, Whiteinch, the steel screw steamer *Banda*, for the Hamburg-Calcutta Line, Hamburg. Her dimensions are :—340 ft. by 42 ft. by 29 ft., measuring about 3,300 tons. She is built to the highest class in Lloyd's and Bureau Veritas, with cellular double bottom right fore and aft, and fitted with all the most approved appliances for the rapid loading and discharging of cargo. She has first-class accommodation for a limited number of passengers, and is fitted throughout with the electric light by Siemens Bros., London. On leaving the ways she was christened in the customary manner by Miss Murray, Glasgow, and afterwards towed to the harbour, where her machinery, which is of the triple-expansion type, will be fitted by Messrs. David Rowan & Sons.

Duchess of Hamilton.—On April 10th Messrs. Wm. Denny & Bros. launched from Leven Shipyard, Dumbarton, a fast paddle steamer for the Caledonian Steam Packet Co., intended for their passenger service between Ardrossan and Arran. Her dimensions are :—250 ft. by 30 ft. by 10 ft. 6 in.; and she is fitted up with a handsome dining and general saloon aft, for first-class passengers, and somewhat plainer dining and deck saloons for steerage passengers, with complete promenade deck above. On leaving the ways she was named the *Duchess of Hamilton* by Miss L. Thompson, daughter of James Thompson, Esq., general manager Caledonian Railway Company.

Marchioness of Breadalbane.—On April 15th Messrs. John Reid & Co., Port-Glasgow, launched from their shipbuilding-yard the first of two saloon paddle steamers, built by them for the Caledonian Steam Packet Co., Limited, for coast traffic. The vessel was named the *Marchioness of Breadalbane*. She will be fitted with compound tandem engines by Messrs. Rankin & Blackmore, of Greenock.

Garnet Hill.—On April 15th Messrs. Russell & Co. launched from their Kingston yard, at Port-Glasgow, a four-masted steel barque, of 2,200 tons net register, to carry 3,600 tons on Lloyd's freeboard. The new vessel, which was named *Garnet Hill*, is of the following dimensions :—Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 3 in. She has been built to the order of Messrs. J. R. Dickson & Co., Glasgow.

Bnte No. 2.—On April 17th there was launched from the yard of Messrs. Scott & Co., Bowling, an iron twin-screw steamer to the order of Messrs. Hill & Co., Glasgow, intended partly for their coast goods trade. Her length is 116 ft.; breadth, 23 ft.; depth, 9 ft.: class 90 A1 at Lloyd's, and will carry a No. 3 passenger certificate. The vessel will be supplied with two compound surface-condensing engines, having cylinders 12 in. and 23 in. by 18 in. stroke, to be supplied by Mr. Wm. Kemp, Govan. As the vessel left the ways she was named *Bute No.* 2 by Miss Ada Hill, daughter of the late Captain James Hill.

Apa.—On April 17th Messrs. Robert Duncan & Co., Port-Glasgow, launched a steel twin-screw steamer, named the *Apa*, of 600 tons register. Dimensions:—Length, 160 ft.; breadth, 33 ft.; depth, 9 ft. She will be supplied by Messrs. Rankin & Blackmore, Greenock, with Rankin's patent disconnecting twin-screw engines, of 9 in., 18 in., and 32 in. by 22 in. stroke. This steamer is for the Paraguayan Development Co. and is intended for service on the River Plate.

Adder.—On April 18th the Fairfield Shipbuilding and Engineering Co. launched for Messrs. G. & J. Burns a fast paddle steamer, which was named the *Adder*. This vessel is intended to conduct the daylight service this season between Scotland and Ireland :—The following are the dimensions of the steamer :—Length, over all, 292 ft.; between perpendiculars, 280 ft.; breadth of beam, 33 ft.; depth to promenade deck, 22 ft. The vessel is fitted with a set of compound diagonal engines, having two cylinders and surface condenser. The diameter of the high-pressure cylinder is 51½ in., and the low-pressure cylinder 93 in., and the stroke 6 ft.; and she is fitted with Wasteneys Smith's patent stockless anchors.

Talune.—On April 19th Messrs. Ramage & Ferguson launched from their building yard, in Leith, a finely-modelled steel screw steamer, built to highest class at Lloyd's for the Tasmanian Steam Navigation Co. for their inter-colonial passenger and goods trade. The vessel will be fitted in the most luxurious style with accommodation for 120 first class and 60 second-class passengers. The greatest attention has been paid to provide every necessary and convenience for the travelling public in this vessel, and special care has been taken with regard to the ventilation of the vessel throughout, which will be done by special fanners driven by a powerful compound engine, while the entire vessel will be lighted by electricity—an installation of the most improved kind is to be fitted for that purpose. On the poop is fitted a spacious social hall, the polished woodwork and upholstery of which will be of the highest class and newest style. The saloon is in the poop, immediately beneath the social hall, on each side of which are fitted large and airy state cabins, having enamelled iron beds, tip-up wash-basins, Axminster carpets, and all necessary appliances for passengers' comfort, neatly japanned side frames in solid oak, maple and other light woods, all highly polished from the sides of the saloon. In the middle of the cabin is a dining-table, having revolving chairs in sycamore, highly polished and upholstered in Utrecht velvet. Light and ventilation is provided by a large well in centre of social hall, round which are fitted columns and rail in light coloured woods highly french-polished. The pantry and bar form the front end of saloon; these are fitted with every convenience for the ready supply of all wants to the passengers, while the cooking arrangements are extensive and complete in every way. At the far end of the bridge are fitted large and airy state cabins, between which there is a large and well ventilated smoking-room. The vessel has been designed to carry 2,000 tons of cargo, as well as the 180 passengers before stated, for the loading and discharging of which, with ease and rapidity, special steam and friction winches have been fitted, also steam windlass, steam steering gear, with all the latest improvements. The vessel will be propelled by a set of the builders' most improved triple-expansion engines, which are to be supplied with steam of 160 lbs. pressure per square inch by a pair of double-ended steel boilers, while all other fittings and furnishings in the engine-room are of the most complete kind. In short, the steamer will be one of the most complete and best appointed, for the trade intended, that has been sent to the colonies. As the vessel glided down the ways into the Firth of Forth she was named *Talune* by Miss Simpson, of Elmhurst, Garstang, North Lancashire. The *Talune* will proceed to the colonies under the command of James N. Bentley, one of the company's most experienced captains, who has been sent for that purpose.

Moss Rose.—On April 19th the Grangemouth Dockyard Co. launched from their shipbuilding yard at Grangemouth, a handsomely-modelled steel screw steamer named the *Moss Rose*, to the order of Mr. Richard Hughes, of Liverpool.

Asphodel.—On April 24th Messrs. Alex. Stephen & Sons, Linthouse, launched a finely-modelled steel screw schooner-rigged steamer of about 2,700 tons gross, built to the order of Mr. J. Bruce Murray, 65, Great Clyde Street, Glasgow. The vessel, which is intended for general trade, has a deadweight capacity of about 4,300 tons, and has been constructed under special survey of Lloyd's for their highest class of 100 A1, three-deck rule, with extra heavy main framing and longitudinal intercostals, dispensing with hold beams, thus leaving large, unobstructed holds for stowage of cargo of the bulkiest description. The vessel has a double bottom on the cellular principle for water ballast, and is fitted with steam and hand steering gear, steam windlass, steam winches, and all the most approved appliances for the economical working of ship and cargo. The vessel has poop, bridge, and topgallant forecastle. Accommodation is provided in house on bridge deck for captain, saloon and spare rooms, while the officers and engineers are berthed under the bridge deck at after end. The engines, which were fitted on board before launching, are of the most improved triple-expansion type, having cylinders 23 in., 37 in., and 59 in. diameter by 42 in. stroke, with two steel boilers suitable for 160 lbs. working pressure. As the vessel left the ways she was named the *Asphodel* by Miss Nimmo, of 26, Belhaven Terrace, Glasgow. The *Asphodel* will be commanded by Captain Thos. C. Saunders, late of the s.s. *Amaranth*, belonging to the same owner, and goes on her first voyage to Java, *via* Alexandria and Batoum.

LAUNCHES—IRISH.

Imaum.—On 25th March there was launched from the shipbuilding-yard of Messrs. Harland & Wolff, Queen's Island, Belfast, a fine steel screw steamer, named the *Imaum*, and built to the order of Messrs. E. Baker & Son, Liverpool. The dimensions of the vessel are as follows:—Length, 400 ft.; breadth, 45 ft.; depth, 32 ft., gross register 4,000 tons. She is intended for the Eastern trade, and is built to highest class at Lloyd's. The *Imaum* will be schooner-rigged, and will receive her entire outfit at the hands of her builders. She will be fitted with triple-expansion engines, and every modern improvement to suit the trade she will be engaged in.

Michigan.—On April 19th a steel screw steamer, named the *Michigan*, was launched from the shipbuilding-yard of Messrs. Harland & Wolff, Belfast. She is designed for the Atlantic Transport Line, and has been built to the order of that company, of which Mr. B. N. Baker, of Baltimore, is the president. Her length is 370 ft.; breadth, 44 ft.; depth, 30 ft. 6 in.; tonnage, 2,700.

LAUNCH—GERMAN.

Concurrent.—On March 26th a new screw steamer was launched by the Flensburg Shipbuilding Co., constructed for Mr. A. Petersen, of Flensburg. This steamer is built of steel to 1st Div. in Bureau Veritas, and has the following dimensions: 200 ft. by 30 ft. 6 in.; by 15 ft. 9 in.; engine 350 H.P. on the triple-expansion principle. As she left the ways she was christened by Miss Petersen.

LAUNCH—SWEDEN.

Thor.—On March 6th the new ice-breaking steamer *Thor*, built at the Lindholmen Shipyard, Sweden, for account of the Danish Government, was successfully launched. She is intended for the Sound traffic between Elsinore and Helsingborg, and will cost about £22,000.

LAUNCH.—SHANGHAE.

Chang On.—On February 2nd Messrs. S. C. Farnham & Co., Shanghae, launched from their lower dock the steamer *Chang On*, a twin-screw vessel built for the Yangtze trade. She is owned by a new company, called the Shanghae Mutual Steam Navigation Co., and flies the British flag. The following are her dimensions:—212 ft. 10 in. long within perpendiculars, and 220 ft. over all; beam, 30 ft.; over guards, 38 ft.; depth of hold, 12 ft., and 23 ft. from upper deck. Her builders' measurement is 932 60/94 tons and she will carry 400 tons deadweight on a mean draught of 8 ft. The hull is built of mild steel, and the engines will be supplied by the builders, and are two pairs of inverted direct-acting compound surface-condensing, of 85 N.H.P. capable of driving the boat at 10 knots an hour. The cylinders are 16 in. and 32 in. in diameter, and the stroke 24 in.

LAUNCH—BREMERHAVEN.

Neptun.—On March 29th the new steamer *Neptun* was launched from the Joh. C. Techlenborg's shipyard at Bremerhaven. She is built for account of the Bergen Steamship Co., Bergen, Norway, and will no doubt be the best fitted out of all Norwegian tourist steamers. She is 210 ft. long and 30 ft. broad, and will be lighted throughout by electricity. The calculated speed is 15 knots, and the size is 600 tons deadweight. The new steamer will be ready for the commencement of this year's tourist season, and will, as far as possible, be fitted with Norwegian manufacture.

TRIAL TRIPS.

Murtaja.—On March 16th the new large ice-breaking steamer *Murtaja*, built at Finboda for the State of Finland, had its trial trip. What ice was encountered was promptly forced. The engine, which is 1,200 H.P., gave a speed of about 12 knots. The trial trip was not final.

Beberibe.—On March 18th the passenger steamer *Beberibe* left the yard of Messrs. William Dobson & Co., Low Walker, for her trial trip at sea. The vessel has been constructed for the Brazilian mail and passenger service of the Companhia Pernambucana. The machinery was constructed by Messrs. Alley & McLellan, Glasgow. A speed of 11 knots per hour was attained.

Rasmara.—Very successful results have been got at a series of progressive speed trials of the new paddle steamer *Rasmara*, built by Messrs. A. & J. Inglis, Pointhouse, Glasgow, for the British India Steam Navigation Co. The vessel is of steel, and is 256 ft. long, 31 ft. beam, and 13 ft. 6 in. deep, the gross tonnage being 900 tons. The engines were designed and constructed by Messrs. Inglis, and are of the triple-expansion type, of which very few have yet been constructed for high-speed paddle vessels. The cylinders are 29 in., 47 in., and 70 in. in diameter respectively, with a stroke of 78 in. The steam pressure is 160 lbs. to the square inch. Twelve progressive runs were made on the measured mile, and the mean speed of the best runs was 16.3 knots an hour, the guarantee being 15 knots. The results as to coal consumption were equally satisfactory.

Edith.—The s.s. *Edith*, built by the Grangemouth Dockyard Co., and engined by Messrs. Alley & McLellan, Glasgow, recently went on her speed trials on the Firth of Forth, and attained satisfactory results, the mean speed being 10 knots. The *Edith* is of the following dimensions:—Length, between perpendiculars, 260 ft.; breadth, 37 ft.; depth, 19 ft. 5 in.; and the deadweight carrying capacity is 2,700 tons. The engines, which are of the triple-compound type, have cylinders 19 in., 31 in., and 50 in. in diameter, by 39 in. stroke, and are supplied with steam at 160 lbs. pressure from two boilers 12½ ft. by 10 ft. The *Edith* is owned by Messrs. Robinson Brothers, Whitby.

Churruca.—This steamer has been fitted with new triple-expansion machinery by Messrs. David Rollo & Sons, of Fulton Engine Works. The vessel's dimensions are—Length, 190 ft., beam, 26½ ft.; depth of hold, 16 ft. The new engines have cylinders 18 in., 29 in., and 46 in. diameter respectively, with 30 in. stroke. The engines are on the three-crank arrangement, and are fitted with steam reversing and turning gear. The engines are supplied with steam of 160 lbs. pressure by a large steel boiler having four furnaces. There is also a powerful donkey boiler for supplying steam to the winches, &c. On April 12th this vessel went out on her official trial. The trials were entirely satisfactory, the vessel giving a mean speed on the mile of 12¾ knots. The owners were represented by Senor José R. de Urrutia, one of the partners in the firm of Messrs. Larrinaga & Co., and the whole of the work was carried out under the superintendence of Mr. James Rode, consulting engineer, Liverpool.

Vauban.—This steamer, built for Messrs. Maurel & H. Prom, Bordeaux, by Messrs. William Hamilton & Co., Port-Glasgow, and engined by Messrs. Blackwood & Gordon, went down the river on her trial trip last month, when she attained a speed of 11½ knots loaded. This steamer is about 1,600 tons register, and has been specially designed for Messrs. Maurel & Prom's African trade, to carry a large cargo on a light draught of water. Her engines are triple-expansion, of 1,100 I.H.P.

Hektos.—On March 19th the new steel screw-steamer *Hektos* built by the Flensburg Shipbuilding Co., made her trial trip. She is built for the Flensburg Steamship Co. of 1869, and is specially constructed for the timber trade, and able to take a large deck-cargo. Her dimensions are: 240 ft. by 34 ft. by 17 ft. and Veritas 1st Division. On a measured distance of 9 sea-miles she got an average speed of 10½ knots. This steamer is the 11th which is built for this company by the Flensburg Shipbuilding Co.

Alfred Dumois.—On March 20th the *Alfred Dumois*, screw steamer, built and engined by Messrs. Blackwood & Gordon, Port-Glasgow, for Mr. Jacob Christensen, of Bergen, Norway, went down the Clyde on her official trial trip, when she attained a speed of 12 knots with fully 300 tons deadweight on board. The dimensions of the vessel are:—175 ft. by 28 ft. by 19 ft. 10 in. to awning deck, and she has accommodation for 16 first-class passengers in well-ventilated, airy cabins on deck, and is fitted with all appliances suitable for the fruit trade between New York and West Indies. She has been constructed of steel to Lloyd's highest class, and is propelled by a set of triple-expansion engines of fully 700 I.H.P., fitted with Morton's patent valve gear, and all the latest improvements, also made by her builders.

Minotaur.—On March 21st the *Minotaur*, formerly flagship of the Channel Squadron, which has been refitted and repaired at Portsmouth, at an estimated cost of £53,000, made a four hours' trial of her machinery. The trial was successful, 4,800 H.P. having been developed by the engines, and a speed of close upon 14 knots realised on the mile.

Windsor.—On March 21st the steamer *Windsor*, a new vessel, built by Messrs. Wm. Gray & Co., of West Hartlepool, for Messrs. Watts, Ward & Co., of London, left West Hartlepool for her trial trip. Her triple-expansion engines are by Messrs. Blair & Co., of Stockton. She made a most successful trip, attaining a speed of about 11 knots.

Pocklington.—On March 21st the steamer *Pocklington*, built by Messrs. Wm. Gray & Co., Limited, West Hartlepool, to the order of Messrs. Lilly, Wilson & Co., went on her trial trip, which was highly satisfactory. The vessel is 248 ft. long, breadth, 34 ft., and depth, 16 ft. 7 in. She carries 1,900 tons deadweight. She is fitted with triple-expansion engines, built at the Central Marine Engine Works, and boilers carrying 160 lbs. pressure per square inch. She is of the well-deck type, and takes the highest class at Lloyd's. The engines were run at the high speed of 83 revolutions per minute, and, after manœuvring for a couple of hours, to the orders of the compass adjuster, off Hartlepool Bay, she proceeded to the Tyne to load for Genoa. The speed of the vessel was over 11 knots per hour, the engines running to the perfect satisfaction of all parties.

Baron Stjernblad.—At the final trip on Saturday, March 22nd, the new steamer gave great satisfaction; speed about 10 knots. The Motala Engineering Co., Sweden, has recently delivered the new steamer *Baron Stjernblad* to the United Steamship Co., Copenhagen. The principal dimensions are:—Length, 212½ ft.; breadth, 31 ft. 2 in.; depth, 18 ft. 10 in.; carrying power, 1240 tons. The engine is on the triple-expansion system.

Amur.—On March 24th this steamer went on her trial trip from the Wear, when she attained a speed of over 14 knots per hour for several hours. The steamer is 215 ft. by 28 ft. by 19 ft. 10 in. to awning deck; having engines by the North-Eastern Marine Engineering Co., Limited, of 200 H.P. nominal; 20 in., 33 in., and 54 in. by 33 in., with large double-ended boilers. She has accommodation in house on deck for 12 first-class passengers, and is fitted throughout with electric light by Messrs. Ernest Scott & Co., of Newcastle-on-Tyne. The vessel is fitted with Harfield's steam windlass, Davis' steam steering gear, and all modern improvements. She has been built for a new service, viz., the conveyance of meat between the Baltic and London.

Eagle.—On March 24th the new steel screw salvage tug *Eagle* had her official trial trip off the Tyne. The vessel was put upon a continuous full-speed trial of four hours, on completion of which six runs were taken over the measured knot, the mean result being that the guaranteed speed of 13 knots per hour was attained. The engines developed 752 I.H.P., at a speed of 108 revolutions per minute. The dimensions of the vessel are:—Length, 125 ft.; breadth, 22½ ft.; depth, 13 ft. 3 in. The propelling machinery consists of a set of triple-compound engines, having cylinders 16, 26, and 43 in. diameter by 30 in. stroke. The boiler, by Messrs. J. T. Eltringham & Co., is of steel of extra capacity, and has a working pressure of 160 lbs. The *Eagle* is owned by Messrs. Huddart, Parker & Co., Limited, of Melbourne, and the contractors for the building of the vessel are Messrs. J. P. Rennoldson & Sons, of South Shields.

Sheldrake.—On March 25th the official natural draught trial of the new first-class torpedo gun vessel *Sheldrake*, 2,735 tons, 4,500 H.P., took place in the North Sea. The machinery was tested on a continuous trial of eight hours' duration, and the results were of a most satisfactory character. The hull of the *Sheldrake* is to be stiffened before she proceeds to sea for her forced draught trial. The vessel has been engined by Messrs. Maudslay, Sons & Field.

Iris.—On March 26th the second-class twin screw cruiser *Iris* made a four hours' full-power trial of her machinery at Portsmouth, after having undergone a general refit and been supplied with a new steel crank shaft in place of the iron one, which had developed serious flaws during last year's manœuvres. The *Iris* was fully coaled in readiness for the forthcoming mobilisation, and was 3 ft. deeper in water than at her former trial. In consequence of the dearth of experienced stokers at Portsmouth, the stokehold was manned in great part by recent entries, many of whom had never been afloat before; but in spite of this fact the trial was very satisfactory. The average boiler pressure was 63 lbs., the revolutions 89½, the vacuum 26 in., and the collective I.H.P. 6,658 without the use of the blast, neither the *Iris* nor her sister ship *Mercury* being fitted to work under forced draught. The mean speed of the entire run, as measured by the patent log, amounted to 17 knots.

Lady Salisbury.—On March 26th the trial trip of the *Lady Salisbury* (s)., built by Messrs. S. P. Austin & Son, of Sunderland, took place on the measured mile off Whitley, and proved successful in all respects, a mean speed of 10½ knots per hour being attained. The machinery, which has been supplied by

Mr. John Dickinson, of Sunderland, worked smoothly and well. The *Lady Salisbury* has been purchased by Messrs. Hawkins, Holman & Co., of London.

Speedwell.—On March 27th the torpedo gunboat *Speedwell* completed the second of her series of progressive trials under forced draught at Portsmouth. The vessel was run for three hours with 3 in. of air pressure in the stokeholds. The engines worked very satisfactorily. The average pressure of steam in the boiler was 134 lbs.; the revolutions were 257½ and 256½, and the collective I.H.P. was 3,584, which was slightly beyond what it was proposed to obtain. The speed upon the measured mile was 19·4 knots, while the mean speed realised during the three hours as determined by log was 19 knots. After another progressive trial, the vessel will be tested at her maximum power. The *Speedwell* carries two of the new 4¾-in. and four 3-pounder quick-firing guns, like the other vessels of the class. Her torpedo impulse tubes are arranged in duplicate upon the same revolving platform, upon the plan patented by Messrs. Yarrow & Co., Poplar.

Amie.—On March 28th the new steamer *Amie*, built by Messrs. Edward Withey & Co., Hartlepool, was taken out to sea on her official trial trip. There was on board a party of gentlemen representing the shipbuilders, engineers, and the owners, Messrs. Burdick & Cook, of London. The usual trial of speed was made over the measured mile with highly satisfactory results, a mean speed of 11½ knots being attained, the machinery working beautifully smooth. The s.s. *Amie* has been constructed under the personal supervision of Mr. Cook, one of the owners, and is a handsomely designed model, and with her taut masts presented quite a rakish appearance. The saloon and passenger accommodation has been most tastefully designed and executed by the decorative staff connected with the builders' firm, and was the theme of general admiration. The engines and boiler have been constructed by Messrs. Blair & Co., Stockton, with all the latest improvements, diameter of cylinders being 21 in., 35 in., 57 in. by 36 in. stroke, steam being supplied from one double-ended boiler of large size, working at a pressure of 160 lbs. Captain Shotton was in command of the vessel, which after the trial trip proceeded to Cardiff to load for a Mediterranean port.

Richard Simpson.—On March 29th the steamship *Richard Simpson*, built by Messrs. Cook, Welton & Gemmell, to the order of the Humber Steam Trawling Co., made her trial trip. She is 110 ft. long by 21 ft. wide, and 11 ft. depth. The engines have been built by Messrs. C. D. Holmes & Co. They are triple-expansion three-crank engines of 60 N.H.P., working up to 420 I.H.P. The cylinders are 14 in., 22 in., and 36 in. in diameter, by 22½ in. stroke, and the boilers have a working pressure of 150 lbs. per square inch. The boat is adapted for trawling as well as line fishing. The trial trip was very successful, the vessel being judged to be a 12-knot boat.

Bonnie Princess.—On March 31st, at 11.30 a.m. (under the command of Captain M'Phedron), the paddle steamer *Bonnie Princess*, belonging to the Liverpool, Llandudno, and Welsh Coast Steamboat Co., left the landing-stage for her trial run previous to beginning the Easter holiday trips, and after undergoing important alterations to her machinery, undertaken with a view to improvement in her speed. The result was most satisfactory, the engines attaining an increased number of revolutions and consequent marked acceleration of speed. The whole hull has had a thorough overhaul, the saloons have been handsomely refitted with a view to the increased comfort of passengers; in fact, no expense has been spared to maintain the reputation of this vessel as the favourite steamer on this really popular route. The vessel has been in the hands of Messrs. Rollo & Sons, of Liverpool, who have carried out the work to the entire satisfaction of the company's consulting engineer, Mr. E. G. Ferber. There were present on this occasion the managing director, Captain G. R. Bell, R.A., and the other directors, Mr. Lewis Lloyd (chairman) and Mr. William Bennett; also the Board of Trade representative, Mr. Currie, all of whom expressed themselves highly satisfied with the results obtained.

Douglas Hill.—On April 3rd the *Douglas Hill*, built by Palmer's Shipbuilding Co., Howdon, was taken out to sea on her trial trip. The vessel was built for Messrs. Evan Thomas Radcliffe & Co., Cardiff. The engines worked with great smoothness, and gave every satisfaction. An average speed of 11½ knots an hour was attained.

Chios.—On April 3rd the new steamer *Chios*, which has just been built and engined for the Deutsche Levante Linie by Messrs. Wigham, Richardson, & Co., went on her trial trip. The speed maintained during a long run was 11¾ knots, and the machinery worked satisfactorily during the whole time. The *Chios* is a vessel intended for the Mediterranean trade, and carries 2,500 tons deadweight on a light draught of water. Her principal dimensions are:—271 ft. over all; 260 ft. between perpendiculars; 36 ft. beam; and 19 ft. moulded depth.

Skotland.—On April 5th the screw steamer *Skotland*, recently launched by Messrs. Thomas and William Smith, North Shields, and built to the order of Messrs. Fisher, Renwick & Co., Newcastle, had her trial trip at sea. Her dimensions are as follow:—Length, 175 ft.; breadth, 28 ft.; depth, 13 ft. 6 in.; tonnage, 605 gross and 367 net. The engines are the triple-expansion, cylinders 13½, 22½, 36 in., and 27 in. stroke, and the boiler pressure 160 lbs., supplied by Messrs. Ernest Scott & Co., Newcastle. The trial was in all respects a satisfactory one.

Shaftesbury.—On April 7th this vessel, which has been built by Messrs. Craig, Taylor & Co., of Stockton, for William R. Rea, Esq., Belfast, was taken on her trial trip with very satisfactory results to all concerned. Dimensions of the vessel are 270 ft. by 37 ft. by 19 ft. 8 in., moulded; her engines are by Messrs. Westgarth, English & Co., of Middlesbro'. Cylinders, 20 in., 33 in., and 54 in. by 36 in.; with two steel boilers 160 lbs. pressure, 1,023 I.H.P. The vessel and her machinery have been fitted out under the superintendence of Joseph Lewis, Esq., consulting engineer, of Belfast. A speed of 11½ knots was attained.

County Down.—On April 7th the screw steamer *County Down*, launched from the yard of Messrs. Clark & Co., Belfast, and engined by Messrs. Wm. King & Co., Limited, Glasgow, went down the Clyde on her trial trip. The vessel is 288 ft. in length, 29 ft. in breadth and 21 ft. in depth. When she left the Queen's Dock she had on board 3,250 tons of cargo, consigned to Rio Janeiro, and on the measured mile at Skelmorlie a mean speed of over 10 knots an hour was made.

Monowai.—On April 10th the screw steamer *Monowai*, built by Messrs. William Denny & Brothers, Dumbarton, for the well-known Union Steamship Co., of New Zealand, underwent her trial trip with most successful results. On trial the vessel did a speed on a mean of four runs of 14·79 knots, being more than one knot over the guarantee. This vessel has dimensions—330 ft. by 42 ft. by 34 ft., and is principally intended for passengers, although she has considerable cargo capacity. She has accommodation for nearly 140 first-class passengers and 100 second. The former are berthed aft on the main deck, and at the sides of the engines and boilers on the port side, while on the starboard side the officers of the ship are located, the engineers being on the deck below. The saloon, which is on the main deck, is very tastefully decorated throughout. At the forward end stands the magnificent sideboard, which many of our readers will, doubtless, remember having seen in the saloon exhibited by Messrs. Denny in the Glasgow Exhibition. The music saloon, situated on the spar deck, also consists of the upper part of that exhibit, transferred almost exactly as it was in the exhibition, with the exception of about 3 ft. being added to its height, giving this apartment the extraordinary headroom of nearly 11 ft. The walls are finished in magnificent satinwood panels. At the fore end stands the alcove containing piano by Brinsmead, while at the after end there is a double staircase leading into the dining saloon. Abaft this again are two special state-rooms entering off the staircase, having a fixed berth below, and a folding-up wooden berth of the builders' own pattern above. Six other similar state rooms are located in the after-deckhouse, where there is also the smoking-room, most tastefully finished in sycamore, satinwood, walnut, and marqueterie. Abaft this again is the steering-house, containing the telemoter and hydraulic rams for working the tiller. The peculiarity of this vessel is that there is a shade deck from right aft to the flying bridge forward of the funnel, only broken at the necessary places to allow of cargo being worked. Under this passengers are absolutely independent of the weather. The vessel is fitted throughout with electric light, supplied by the builders, there being double sets of dynamos and engines. For ventilation purposes she is fitted with one large fan, made by Messrs. M. Paul & Co., and driven by one of their special engines. She has also a refrigerating machine on the Kilbourn patent principle, which is located forward under the second class accommodation, the chamber being large enough to carry many days' supply of food for all the passengers. The whole of the cargo gear throughout is on the hydraulic principle, by Messrs. Brown Brothers, of Edinburgh, there being two of their newest principle derricks aft, one fastened to the main mast, while the heel of the other is shipped on a special construction on the top of the music room. At the fore hatch there is also one of these derricks; while for the fore main hatch there are two special hoists on Brown Brothers' hydraulic principle. The windlass is also worked by this power, and the ship steered by means of two rams placed aft, connected with the flying deck by a telemoter, an ingenious contrivance for doing away with all steering chains and rods. The propelling machinery consists of a set of triple-expansion engines, driving a propeller having a cast-iron boss and manganese bronze blades, while steam is supplied by two double-ended boilers, working at a pressure of 170 lbs. per square inch. The engine-room is most extensively provided for, all manner of auxiliary machinery being supplied—two Weir's pumps for boiler feed, three Worthington's pumps, centrifugal circulating pumps. Brown's patent combined steam and hydraulic starting gear, Weir's patent feed heater and distiller, &c., &c.

Banes.—On April 10th the new steel steamer *Banes*, recently launched by the Grangemouth Dockyard Co., went down the Firth of Forth on her official trial trip. A speed of 12½ knots loaded was obtained. The *Banes* has been built to the order of Messrs. Harloff & Boe, Bergen, and is intended for the Central American fruit trade.

Denia.—On April 12th the steel steamer *Denia*, built by the Sunderland Shipbuilding Co. Limited, for Messrs. Adam Brothers & Co., who have since sold her to the Compania Valenciana de Navegacian of Valencia, went for her trial over the unmeasured mile, and averaged a mean speed of 11½ knots, her engines, which were supplied by Messrs. Black, Hawthorn & Co., of Gateshead, of 950 I.H.P., giving great satisfaction to all on board. Her principal dimensions are as follow:—Length, 250 ft.; breadth, 35 ft.; depth, 22 ft. to spar deck. She has a cellular double bottom fore and aft, and is fitted with steam steering gearing, steam windlass, and all the latest improvements, with a large saloon aft for the accommodation of captain and a few passengers.

Aquila.—Various papers received from Italy contain accounts of the gala trial last month of the Transatlantic steamer *Aquila*, built by Messrs. Wigham, Richardson & Co., for the house of Frateli Lavarello, of Genoa. The *Aquila* had already proved herself one of the fleetest Transatlantic steamers running out of Genoa, and last week, with a distinguished company of 500 ladies and gentlemen on board, she ran in her voyage trim from Genoa to La Spezzia and back, a distance of about 100 miles, and attained more than a knot above the contract speed.

Kassara.—On April 19th the steamer *Kassara*, built by the Ailsa Shipbuilding Co., Troon, for the British India Co., made her trial trip. The sail extended from Troon to the Gareloch, Loch Long, and back to the Girvan coast, thence to Troon. The *Kassara* was in fine trim, and had 800 tons of coal on board, and with the tide against her on entering the Clyde she ran the distance between the Cumbrae and Cloch Lighthouse in 58 minutes, being at the rate of 14·137 knots, being considerably over the speed required, which was 13¼ knots. Her dimensions are 240 ft. by 34 ft. by 17 ft. 6 in. to main deck; 25 ft. shade deck.

Paranagua.—On April 21st Messrs. Raylton, Dixon & Co., of Middlesborough, sent to sea the new screw steamer *Paranagua* which has been built by them to the order of Cie Chargeurs Réunis, of Paris and Havre. This vessel was built on the spar deck rule to obtain the highest class French Veritas and of a very handsome model. She is fitted for the accommodation of 650 passengers, her entire between decks being occupied in this way with all the necessary arrangements for an emigrant steamer, and is intended to form one of the important line of this company between France and the River Plate. Her dimensions are:—Length, 305 ft.; beam, 38 ft.; depth, moulded, 24 ft. 6 in.; and she is fitted with engines by Messrs. T. Richardson & Sons, of Hartlepool, which gave a speed on trial trip of over 12 knots. After some hours' satisfactory steaming, the *Paranagua* went direct to Havre, from whence she will sail for South America at the latter part of the present month.

Salamander.—On April 21st the *Salamander*, 2, first-class torpedo gun-vessel, 735 tons, 4,500-H.P., recently built at Chatham Dockyard, left Sheerness for the official trial of her engines and boilers under natural draught. Her machinery was tested on a continuous run of eight hours' duration in the North Sea, in the presence of engineering officials from the Admiralty, Medway Steam Reserve, and Chatham Dockyard. The results were of a most satisfactory character, and the *Salamander* returned to Sheerness Harbour. She is to be completed for commission without delay, her forced trial being postponed until after the *Seagull*, a vessel of the same class, has completed her progressive trials at Portsmouth. The *Salamander* has been engined by Messrs. Maudslay, Sons, & Field.

Trafalgar.—On April 22nd the *Trafalgar*, battleship, bearing the flag of Rear-Admiral Lord Walter Kerr, second in command of the Mediterranean Squadron, made a very successful commissioned trial of her machinery at Portsmouth in charge of the officers of the Steam Reserve. The trial lasted for three hours. With from 80 to 83 revolutions she developed a *maximum* of 7,900 H.P., and realized a mean speed of 15 knots.

Tyrian.—On April 23rd the new Union Co.'s royal mail steamer *Tyrian*, constructed by Messrs. Day, Summers & Co., Northam, Southampton, for the mail service on the South African coast, underwent her official trial in Stokes Bay, when she attained a mean speed of 13 knots on the measured mile, and developed 1,216 H.P. The *Tyrian* is a steel vessel of the following dimensions:—Length, 260 ft.; breadth, 33 ft.; depth, moulded, 16 ft. 10 in. She is classed 100 A 1 at Lloyd's, and has a gross tonnage of 1,455. She has been specially designed for the company's trade on the South African coast, and every convenience that modern science has provided is furnished for the convenience of a large number of first, second, and third-class passengers, and the speedy loading and discharging of cargo. Water ballast is provided in the fore peak and main and after holds. The saloon is on the main deck in front of the machinery space, and extends from side to side of the vessel. It is handsomely fitted, and is decorated in white and gold. The first-class sleeping cabins are forward of the saloon on the main deck, and are fitted with wire-woven spring folding-up berths, and patent mahogany folding-up lavatories. Electricity is used in lighting and for bell communication. The second-class saloon and sleeping-cabins are arranged abaft the machinery space on the main deck, and the fittings are identical with those of the first-class cabins. The accommodation for third-class passengers is situated under the forecastle on the main deck, the entrance being from under the forecastle deck. The ventilation of the ship has received special attention, and the electric light and appliances have been fitted by Messrs. Siemens Brothers & Co. The engines are on the triple-expansion principle, with three cranks, and are fitted with the latest improvements. The cylinders are 21 in., 34 in., and 75 in. diameter, by 36 in. stroke. There are two boilers, each 13 ft. diameter by 11 ft. long, built of steel, with three of Fox's corrugated furnaces, and the working pressure is 160 lbs. per square inch. The total heating surface is 3,400 square feet, and the grate surface 115 square feet. The *Tyrian* has been placed under the command of Captain J. Morton, and, having passed her official trial, is to take up her position on the South African coast about the middle of May. The *Tyrian* left Southampton Docks at about 11.30 for the official test in Stokes Bay. There were then on board Messrs. W. G. Nicholson and Rohmer (directors of the Union Steamship Co.), Mr. J. Lungley (deputy-superintendent of the company), Mr. Dusantoy, R.N.R. (superintendent engineer), Colonel Harman, Mr Steele, R.N. (Board of Trade surveyor), Mr. J. T. Messum comptroller of mail packets for the General Post Office), Messrs. A. J. and G. Day (representing the builders), Mr. E. A. Hart (secretary to the company), and Mr. G. Nicholson. The steamer made a quick run down to Stokes Bay, and was at once put on the measured mile, which she ran four times with the wind and tide, and against those forces. The results were highly satisfactory. The engines registered, as stated, 1,216 H P., and made 88 revolutions per minute, whilst there was a pressure of 160 lbs. per square inch on the boilers, and vacuum was at 27. The mean speed attained was 13 knots an hour—this is one above contract, which specified 12 knots. The displacement of the vessel is 1,750 tons, and she drew 11 ft. 2¼ in. forward, 14 ft. 10¼ in. aft, and 13 ft. ⅜ in. beam.

Prudence.—On April 24th this vessel, 292 ft. by 37 ft. by 26 ft. 8 in., built by Messrs. Craig, Taylor & Co., of Stockton, for Mr. Alfred Suart, of London, to carry oil in bulk, was taken on her trial trip. She has engines by Messrs. Westgarth, English & Co., of Middlesbro', cylinders 22 in., 35 in., 57 in., by 39 in., 160 lbs. pressure, I.H.P. 1180; pumping and electric light installation by Messrs. Hayward, Tyler & Co., London. The Yaryan Co.'s patent evaporator and Kircaldy's feed heater fitted to the engines.

Cygnet.—On April 24th this ship belonging, to Messrs. George Nelson & Sons, of Liverpool, after being fitted with new boilers and the engines tripled by Messrs. Westgarth, English & Co., Middlesbro', was taken out for trial with satisfactory ults.

Review.

talogue of Ship-Model Fittings.

Messrs. Kelso & Co., of Commerce Street, Glasgow, the noted mechanicians whose handiwork, in the way of ship-model fittings has been the subject of admiration in all the recent exhibitions connected with naval architecture, have sent us an illustrated catalogue of their ship-model fittings, in which they draw attention to the ease and facility (also the large expense saved in making out special drawings) with which customers, availing themselves of it, are enabled to order what they require. Affixed to the illustrations of every separate item is a reference number; by simply quoting which, along with the number of page on which it occurs, customers are assured of receiving in due course, and in perfect order, the article corresponding. The lengthy and extensive experience of the firm in the manufacture of ship-model fittings has enabled them to present a sufficiently comprehensive variety of illustrations. These represent the fittings most commonly in use on modern ships of all classes, but, of course, any desired modification in the general form, or in particular details, of any of the articles can be easily and accurately effected. The illustrations are on a scale of ¼-inch per foot, but, from the same sketches, the articles can be made on a scale of ⅛-inch or ¼-inch per foot, as required. A large ready-made stock of the articles most commonly in demand is always kept in stock by the firm, and, unless in the case of some specialized article, customers are asked to rely on being supplied with the same facility and despatch which the catalogue under notice enables them to be ordered with. The firm, as hitherto, the catalogue states, are prepared to undertake the supply of any article of model-fitting, whatever its nature may be, when provided with the necessary sketches. They are also now making a speciality of supplying all kinds of ship-models *complete* with or without glass-cases and stands. Altogether, the catalogue, which is tastefully got up, and extends to about forty pages, will prove of great convenience to all who entrust Messrs. Kelso and Co. with their orders.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE "S S. METEOR."

To the Editor of The Marine Engineer.

Sir,—Your publication of Mr. Young's letter, with the cards from s.s. *Meteor*, must have been interesting to your readers.

I would like to ask Mr. Young if he has taken diagrams from L.P. engine without the jacket on, and how much greater the power is with the jacket than without.

D. R.

Middlesbro', April 21st, 1890.

UNQUALIFIED ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—As a constant reader of your valuable journal, kindly permit me to write a few lines on a subject which I think it is time someone took up. There are at the present time near upon 100 steam trawlers and codmen sailing out of the river Humber from Grimsby and Hull, varying from 20 to 60 H.P. Some of these have been fitted with triple-expansion engines. I *myself* have been in six ships, codmen and trawlers, varying from 35 to 50 H.P., all being fitted with triple-expansion engines. Some of these ships are employed in the Faroe and Iceland Fishing. And I think, for the interests of life and property, that the engineers of these ships ought to pass some sort of examination and hold a certificate to shew they have been a certain time at sea, and are qualified, as I know that plenty are sent by the owners that cannot pack a gland, or do anything else to an engine, providing anything serious should occur. These are the kind of men that owners fly to, providing there is any dispute about wages.

If you would permit this to be published in your valuable paper, some person might bring the matter before the Board of Trade, and then I think you would confer a great favour on a good many men who are obliged to take ships to sea for what money owners think fit to pay, or else allow other men that are not qualified for the position to go to sea in their room.

I remain, yours, &c.,
Grimsby Steam Trawler.

Miscellaneous.

The "Majestic's" First Voyage.—The White Star Liner *Majestic* arrived at Sandy Hook at 8.15 p.m., April 9th, and reached deck at 7.30 a.m., April 10th, the time from Queenstown being six days 10 hours and a half. This is the quickest first trip from Queenstown ever made, being two hours shorter than the *Teutonic's*. The distances run daily were:—First day, 420 miles; second, 414; third, 467; fourth, 412; fifth, 455; sixth, 471. The officers report strong headwinds throughout the voyage. The vessel behaved admirably. Experts in shipbuilding highly approve the design upon which the *Majestic* was constructed. They describe her as the realization of a single idea, without any after-thoughts, or such patchwork as is common in such immense constructions. The ventilation of the fire-room is admirable; not a single man was disabled on the voyage, whereas on the *Teutonic* fainting was of daily occurrence. The fore and aft bulkheads between the boilers and engines almost remove the possibility of such a complete collapse as was suffered by the *City of Paris*. The only defect pointed out is that the *Majestic* has no pumps independent of the main steam supply. The officials here think it probable that passenger steamers will be compelled to fit such pumps on pain of the refusal of the inspector's certificate.

Gunboats for the Zambesi.—The British Government has recently instructed Messrs. Yarrow & Co., of Poplar, with the construction of two steel shallow draught steamers to serve as gunboats, of special design, for the navigation of the Zambesi and Shiré. These boats merit attention owing to the novelty of their construction. They are of the stern-wheel type, 90 ft. in length by 16 ft. beam, and having a draught of from 18 in. to 2ft., and are of about the same tonnage as the passenger steamers plying between London-bridge and Chelsea. They will be shipped in pieces and put together at their destination. The most remarkable feature of Messrs. Yarrow's contract is that they have undertaken to put them together at the mouth of the river, and have them ready for steaming within 24 hours after arrival without going ashore or having any recourse to the land on either side of the river. At the same works there are being built side by side with the English boats six boats for the Portuguese Government, also for service in the same district. These were contracted for immediately after the recent expedition up the Zambesi in three steamers also built by Messrs. Yarrow, of which Major Serpa Pinto was in command. The Portuguese will therefore before long have a small fleet, consisting of nine gunboats, on the Zambesi.

Dredging Extraordinary.—Last month the dredger *Preston*, built by Messrs. Fleming & Ferguson, Paisley, belonging to the Corporation, and at present working in the Ribble two or three miles below the Bull Nose, lifted 20,000 tons of clay and gravel in 46 hours, a most extraordinary record in dredging annals. Such a feat has, so far as can be learned, never before been achieved by any dredger afloat; and it speaks highly for the capability of the huge machine and the thorough efficiency of its management.

The United Asbestos Company, Limited, whose chief offices are at Dock House, Billiter Street, E.C., have recently opened an additional branch house at Provident Buildings, Clare Street, Bristol. The company's business is extending, and they have new branch houses in Glasgow, Newcastle-on-Tyne, Manchester, Liverpool, Cardiff, Bristol, Paris, and St. Petersburg.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships from March 19th to April 19th, 1890.

4162 H. E. Newton. Boilers and boiler furnaces. (G. J. Cartwright, New South Wales.)
4166 C. Cornero. Propelling and steering ships.
4168 J. E. Spanoghe. Screw propellers.
4169 E. Edwards. Metallic packing. (W. Gminder, Germany.)
4184 C. J. Howe. Raising, lowering and disengaging boats.
4195 G. W. Hawksley. Furnace grate bars.
4203 J. Vicars, T. Vicars & J. Vicars, the younger. Mechanical strokers.
4244 E. N. Galloway & J. H. Beckwith. Expansion valves and gear for steam engines.
4250 J. Marshall & R. Wigram. Engine valves.
4320 C. J. Jones. Boilers.
4389 H. Lawrence. Working the slide valves of steam-engines.
4431 J. T. Howson & H. Milnes. Flues of steam boilers.
4432 E. Field. Motive power engines.
4433 W. Bell. Valve gear.
4503 F. Thomas. Lowering ships' boats.
4656 H. H. Lake. Screw propellers.
4714 O. Wilde. Cut-off motion for steam engines.
5071 A. J. Boult. Piston packing for steam engines. (F. D. Child, United States.)
5117 W. H. Wilson & J. Welsh. Steam boiler furnaces.
5130 T. W. Lapworth & A. W. Hayes. Water tube steam boilers.
5277 J. Kirkaldy. Reducing valves.
5278 J. Kirkaldy. Steam boilers.
5347 W. P. Thompson. Means for distinguishing vessels in fogs. (W. Nelson, United States.)
5350 C. Schütz. Controlling valves.
5379 O. Phalp. Ships' ventilators.
5389 H. W. Houlden & R. Morris. Steam engines.
5393 D. Cameron. Steam boilers.
5410 T. G. Lishman. Steam boiler furnaces.
5470 P. Mugel. Steam pumps.
5487 E. J. Duff. Steam boilers.
5517 W. Chambers. Steam generators.
5533 C. Wells. Steam engines.
5570 J. Riley & E. J. Duff. Furnaces of water-tube steam boilers.
5603 J. Proctor. Mechanical strokers for steam boiler furnaces.
5702 G. E. Hansen. Fixing tubes in marine and other boilers.
5729 F. J. Weiss. Governors.
5775 T. Veasey & M. Brough. Packing for steam, hydraulic and other stuffing boxes.
5799 J. Reid. Governor.
5844 W. B. Leachman. Generating steam and economising fuel.
5851 J. Reid. Self-lubricating valve spindle.
5878 J. Wild. Valve gear.
5922 P. Oriolle. Steam boilers.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

Extra First Class.

April 19th. Peacook, A. N. .... E1C N. Shields

March 22nd, 1890.

Barnes, Walter W.	2C	Cardiff
Barton, James ..	2C	N.Shields
Davies, Ogley ..	1C	Cardiff
Dixon, W. S. ..	1C	London
Dorman, Wm. F.	1C	Liverpool
Freeman, Wm. P.	1C	N.Shields
Garbutt, Frdk. W.	1C	,,
Garlick, John B.	2C	London
Geddes, Chas. S.	2C	,,
Boulden, Thomas	1C	Cardiff
Candiliotis, Mchl.	1C	,,
Davison, Wm. M.	1C	N.Shields
Dove, John James	1C	W. Hrtlpl
Edwards, Morgan	2C	Cardiff
Evans, Evan ..	2C	,,
Fosbrooke, W. A.	1C	Liverpool
Friend, Wm. C.	2C	N.Shields
Gallon, Robert..	1C	,,
Gatheridge, T. R.	2C	Cardiff
Gemmel, F. R...	1C	Liverpool
Gibboney, Peter	1C	Aberdeen
Henderson, David	1C	Liverpool
Hooper, Alfred	1C	Cardiff
Hoult, James T.	2C	London
Jensen, Fredk. T.	1C	,,
Kidd, Henry F.	2C	N.Shields
Kirby, John S.	1C	,,
Manson, Thos. N.	2C	W. Hrtlpl
Miller, Thos. B.	1C	N.Shields
Morgan, Thomas	1C	Cardiff
Nositer, Thos. W.	2C	W. Hrtlpl
Probert, Joseph	1C	Cardiff
Pullen, Frank ..	1C	London
Reay, Edward ..	2C	N.Shields
Reid, Alfred ..	2C	,,
Riddell, Neil ..	2C	,,
Riley, Victor W.	1C	London
Treatt, Ethelred	2C	Cardiff
Turnbull, John	1C	Liverpool
Webber, Albert	2C	Cardiff
Werner, John R.	2C	London
Williams, Wm. H.	2C	Cardiff

March 29th, 1890.

Alby, George ..	2C	Sunderl'd
Barnes, Matthew	2C	N.Shields
Beckwith, Oliver	2C	Glasgow
Binks, C. A. ..	2C	Hull
Blakey, Henry S.	2C	,,
Blakey, Joseph S.	1C	,,
Bloomfield, Rd.	2C	Liverpool
Butchart, John J.	2C	N.Shields
Cameron, Wm.	2C	Liverpool
Carrick, George	2C	Sunderl'd
Carrick, George	2C	Glasgow
Colbridge, John	2C	Hull
Downs, Samuel	2C	Sunderl'd
Evans, Arthur J.	1C	,,
Fletcher, Thomas	2C	,,
Gash, Arthur ..	2C	Hull
Gillespie, Peter	2C	Glasgow
Graham, Thomas	1C	Sunderl'd
Hughes, John J.	2C	Liverpool
Jeffery, James R.	1C	Glasgow
Leith, Alfred J.	1C	London
Lewins, Frank	1C	Sunderl'd
Lewis, Harry ..	2C	London
Macpherson, Jhn	2C	Glasgow
McDowall, Wm.	1C	,,
Page, Arthur B.	1C	Hull
Pollett, John E.	2C	London
Russell, Arch. A.	2C	Glasgow
Scholefield, Hrbrt	2C	Liverpool
Simey, George..	2C	Sunderl'd
Storms, Peter M.	1C	Liverpool
Thomas, John ..	2C	N.Shields
Thomas, Wm. O.	1C	Liverpool
Turner, Thomas	2C	Hull
Watson, Chas. E.	1C	N.Shields

April 5th, 1890.

Anderson, Joseph	2C	Liverpool
Baber, Samuel E.	2C	Plymouth
Barr, Hugh ..	2C	Liverpool
Bolam, Joseph..	2C	Sunderl'd
Brookbank, Alex.	2C	N.Shields
Budd, Harold S.	2C	Liverpool
Charles, Wm. ..	1C	Cardiff
Coke, Thomas ..	1C	Liverpool
Gill, Richard ..	1C	Cardiff
Hardy, John H.	1C	N.Shields
Heath, Louis L.	2C	Cardiff
Hunter, John ..	2C	N.Shields
Hutchinson, Wm.	2C	Liverpool
Kelly, Henry F.	1C	,,
Paterson, Wm...	1C	,,
Pritchard, Richd.	1C	N.Shields
Rafalias, D. ..	1C	Cardiff
Reid, James L...	2C	London
Robertson, Wm.	2C	,,
Rogers, Ernest G.	2C	,,
Seymour, Richd.	2C	Cardiff
Smiles, Robert T.	2C	N.Shields
Stead, Harold ..	2C	Liverpool
Trewartha, F. J.	2C	London
Wardropper, Wm.	1C	N.Shields

April 12th, 1890.

Alexander, Robt.	1C	Leith
Auld, John ..	2C	Greenock
Burnett, Norman	2C	N.Shields
Craigie, James R.	2C	Dundee
Croll, George ..	1C	,,
Donald, James S.	1C	,,
Edward, Peter ..	2C	Greenock
Forsyth, George	1C	Leith
Girdwood, Adam	2C	Dundee
Hall, George A.	2C	N.Shields
Hall, Thomas ..	1C	Glasgow
Harvey, Robert	1C	Greenock
Irving, George .	2C	Glasgow
Laidler, Thomas	2C	Leith
Lubbers, F. W...	1C	Cardiff
Lund, Wm. C. ..	2C	N.Shields
McGee, M. ..	2C	Glasgow
McKenzie, Alex.	2C	Greenock
McNaughton, Jas.	2C	N.Shields
Munro, Colin ..	2C	Greenock
Robertson, Arch.	2C	N.Shields
Sheriff, John Wm.	2C	,,
Simpson, Bruce	2C	Leith
Simpson, Wm. B.	2C	,,
Sparks, James ..	2C	Dundee
Stewart, Daniel	2C	Glasgow
Stokes, Fredk. ..	1C	Greenock
Thomas, D. J. ..	2C	Cardiff
Thomson, James	2C	Glasgow
Thomson, James	2C	London
Ward, A. A. ..	1C	Cardiff
Wilkie, John S.	1C	N.Shields

April 19th, 1890.

Allan, Jno. ..	2C	London
Armstrong, Wm.	1C	Liverpool
Ashton, Alf. J...	2C	London
Barclay, Clifford	2C	Liverpool
Cass, John J. ..	2C	W. Hrtlpl
Cornhill, John ..	1C	Liverpool
Czaikowski, C. J.	1C	W. Hrtlpl
Dowd, Thos. ..	1C	London
Forbes, Henry ..	1C	S'hamton
Gelbie, John ..	2C	Liverpool
Girdwood, James	1C	W. Hrtlpl
Hall, John J. L.	2C	N.Shields
Hood, Wm. ..	2C	W. Hrtlpl
Knowles, Wm. H.	2C	,,
Mackenzie, Chas.	1C	London
Scott, George ..	1C	N.Shields
Shields, Wm. H.	2C	W. Hrtlpl
Shuttleworth, G.	1C	Liverpool
Stainistreet, Sml.	2C	,,
Taylor, James ..	2C	London
Thew, John J...	2C	W. Hrtlp
Vattier-Kraane, C	2C	London
Watson, Thos...	2C	N.Shields
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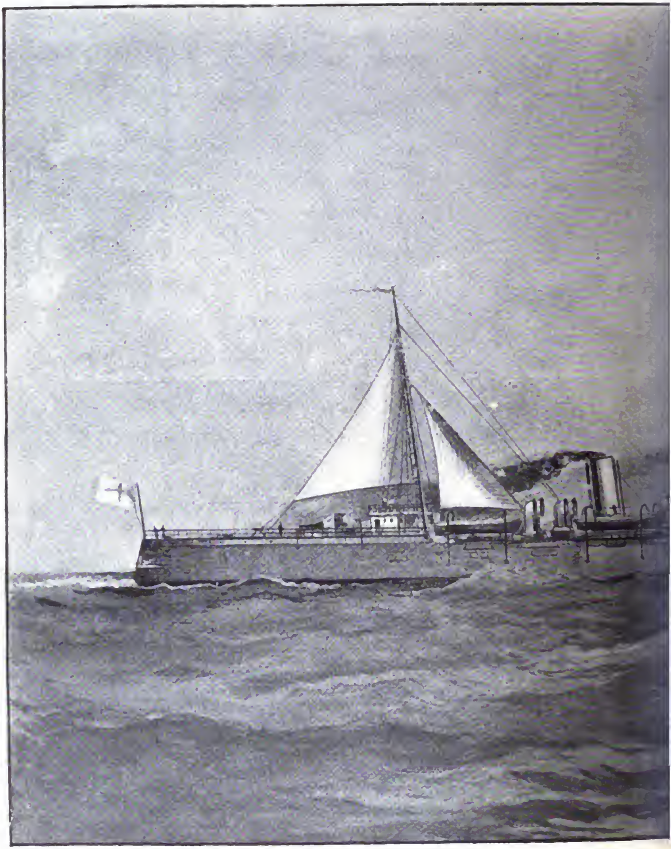
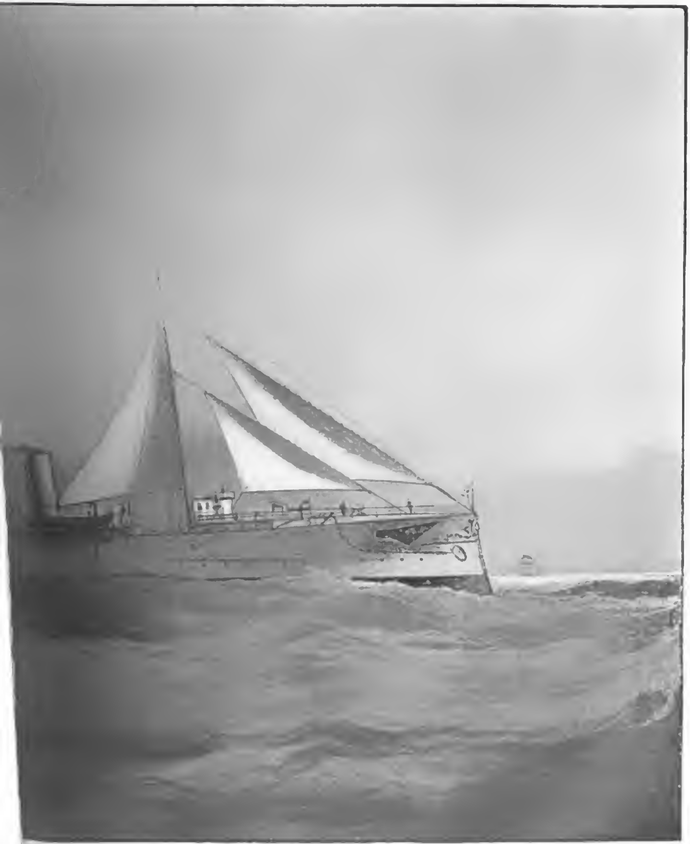


HER MAJESTY'S ARMOURED CRUISER "LATONA," BUILT

(For Descript



HE Naval Construction and Armaments Company, Barrow-in-Furness.

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The Marine Engineer.

LONDON, JUNE 1, 1890.

EVERY improvement in the means of transport brings in its train new possibilities, and often new requirements. Amongst those which the modern economical high-pressure marine engine has made necessary in the conduct of our great ocean trade, is the auxiliary feed for the high-pressure marine boiler. This supply of fresh water and the means of producing it have become matters of vast importance to all steamship owners, and they consequently have formed the subject recently of considerable attention in papers and magazines dealing with engineering and steamship details. Until the last few years the real importance of the condenser and distiller at sea had not made itself seriously felt, but the supply of water to make up for waste in the boilers of compound and triple-expansion engines has raised these things to an importance almost equal to that of the boiler itself. There are five means by which the supplementary feed supply of marine boilers may be secured. Firstly, by the old method of taking water to make up waste direct from the sea. The result of this practice with high-pressure boilers has been eminently unsatisfactory, greatly deteriorating the boilers, lessening their evaporative efficiency, and causing serious accidents due to accumulation of thick scale on the heating surfaces. One thousand gallons of sea water evaporated in a boiler per hour would throw down upwards of 100 lbs. of deposit in twenty-four hours. Secondly, by fresh water carried in supply tanks, which can only be done with advantage in steamers engaged on short runs, and where the question of carrying 100 tons less cargo is of no moment. It must be borne in mind that every ton of water carried shuts out a ton of cargo, and to the cost of this must be added the price paid for the water itself. Thirdly, treating sea water chemically, with a view to purify and render it fit for use in steam boilers. To do this it becomes necessary to mix with the salt water some compound, such as carbonate of soda, for the purpose of precipitating the calcium and magnesium salts, which form such an important element in sea water. The dimensions of the vessel in which this precipitating process is to be carried out would be such as to cause great inconvenience in an ordinary-sized engine-room, and the ordinary rolling and pitching motion at sea would prevent the operation being conducted in a satisfactory manner. Again, engineers of a steamer have quite enough to do in these days of small crews to drive the ship on her way and see that the propelling machinery is kept in efficient working order, without having to wade through and rectify difficulties in the water-heating apparatus, which must require considerable practice, time, patience, and nice manipulation on the part of any one man to work efficiently; allowing that to be possible, the attention devoted to the carrying out of this process causing a corresponding amount of neglect of his own legitimate duties in looking after the propelling machinery. In addition to the weight of the special heating apparatus and cost of upkeep, it would be needful to take strict account of the cost of the chemicals used; then if steam were used as part of the process, the quantity of steam used as a question of expenditure of fuel, and what became of the fresh water from which the steam was originally produced, would have to be carefully noted. No trial of this means of procuring a supplementary feed supply has as yet been made on a commercially economical basis, but it has been tried on a large laboratory scale with that object. Fourthly, by using an auxiliary boiler to evaporate sufficient salt water for feed make-up. This is a crude and extravagant method of arriving at the end in view. The heating surfaces soon get thickly coated with scale, when the evaporative efficiency per pound of coal is reduced to a minimum. The system has nevertheless found users, but in several cases the fire-boxes have been completely destroyed, having probably saved the main boilers at the expense of the auxiliary boiler. The system is moreover unsatisfactory with reference to working expenditure, including, as it does, the time of attendant, the large quantity of coal expended, and the fact that if this boiler is intended for use in discharging cargo in port, it is not generally available for this duty until it has been thoroughly cleaned and most likely extensively repaired. Fifthly, the make-up feed may be produced by evaporation of sea water by steam, which, though giving up its heat to evaporate the salt water, is not allowed to come into contact with it. This is without doubt the most economical and efficient means of securing a fresh water supply, as it avoids salting up boilers, using chemicals, or wearing out auxiliary boilers. Several apparatus are now made, and are largely used for this purpose; into their construction and respective merits we need not enter; but it is clear that if the troubles already referred to are to be avoided, the apparatus should be made of the best materials and workmanship, and the internal parts of such metals as are not acted on injuriously by hot sea water. The solid matter left in the evaporator by the removal of the fresh vapour should be drawn off by the admission of more water than is evaporated, this surplus portion being taken from the evaporator in a very dense state, due to the admixture with it of the matter left behind by the removal of the vapour. This hot brine should not be allowed to run into the bilge, as it becomes a source of discomfort to those in charge of the engine, and will certainly attack the floors, frames and plating of the hull exposed to its contact.

Special attention should be given to the means for admitting the sea water which is evaporated; these ought to be automatic, and should be so arranged that if the feed valve leaks or gets set fast, the fact will be evident, and the valve easily liberated. Apparatus of this kind, necessary as it is, should not add materially to the number of duties of the engine-room staff. There should be no difficulty or attention required with respect to the proper supply of water to the evaporator, and it should be impossible for this vessel to fill. It is of the greatest importance that in arranging make-up feed evaporators, that the passage of water from the evaporating vessel into steam pipes under any circumstances may be impossible, or damage, more or less serious, will result. The importance of the possession of the feed make-up water only exceeds that of the arrangement of the apparatus for producing it, so that it will be certain and amply sufficient in its action. As a detail of the evaporator itself, the means used for admitting and regulating the supply of sea water need special consideration and care. The entrance of water into an engine may be productive of such calamitous results, that no pains should be spared to prevent it by any chance getting there from the evaporator. There should not only be an automatic water admission, but an equally automatic emission, so that should any stoppage of evaporation occur, the admission of sea water may also be caused to stop. This may seem to be a difficult requirement, but a little consideration will show that this end may be attained, and possibly in more ways than one. Too much emphasis cannot be placed on this point or attention paid to it, as on it very much depends the success or failure of the evaporator as an automatic apparatus to be placed in an engine-room. The experiment has been tried of taking the vapour into the low-pressure cylinder jacket, in order to get a certain amount of work back for the heat expended. We have no definite information as to the result of this, but as a practice it would appear to be open to objection that if the sea feed connections are not thoroughly trustworthy accidents may arise from overflow of water where steam or vapour alone should pass. The better plan is to use the vapour for heating feed-water or to pass it into the main condenser. The provision of ample feed make-up involves a large number of interesting points in practice and in theory, and the economical advantages derivable from the efficient working of well-made apparatus have not been sufficiently recognised by shipowners.

Propulsion by electricity is effectually demonstrated at the Edinburgh Exhibition. The site favoured this, as it is skirted by the Union Canal, and four launches are running on the canal. These were designed by Messrs. Morton & Williamson, Glasgow, and built by Messrs. T. B. Seath & Co., Rutherglen. The dimensions are 40 ft. long, 6 ft. 6 in. beam, and the draught of water is 2 ft. 1 in. They each carry forty passengers. The electrical equipment has been supplied by Messrs. M. Immisch & Co., London, and is similar to that used on the Thames launches. The charging plant consists of a 25 H.P. engine and an Immisch dynamo, and the switch arrangement is suitable for charging all the four launches at the same time. The recharging is done during the night and the launch can run ten to twelve hours. The motors are capable of an output of about 3½ brake H.P., working up to 800 revolutions per minute, and the speed with the maximum load on board is six miles an hour. The propellers are coupled direct to the motor shafts. A ball-bearing thrust-block is attached to the motor's bed and is constructed in combination with the plain bearing of the motor. This is the invention of the Messrs. Immisch, and has been patented by them. The steering, starting, and reversing gear is so arranged that one man has the launch entirely under control. These, so far as we can learn, are the first electric launches which have been worked commercially in Scotland.

The Accident to the "City of Paris."—In the House of Lords on May 20th, Lord Norton, on behalf of Earl de la Warr, asked whether it was the intention of Her Majesty's Government that the inquiry into the case of the steamship *City of Paris* should be held in open court, to which the public would be admitted. Lord Balfour of Burleigh, in reply, said that the inquiry would be held in open court, but owing to the materials not being ready, the inquiry could not be opened until the middle of next month.

RESEARCH COMMITTEE ON MARINE ENGINE TRIALS.*

REPORT UPON TRIALS OF THREE STEAMERS, "FUSI YAMA," "COLCHESTER," "TARTAR."

By Professor Alexander B. W. Kennedy, F.R.S., *Chairman.*

1.—Trial of the s.s. "Fusi Yama."

Steamer.—This steamer was tested as a good example of an ordinary trading vessel working under the usual conditions. She belongs to Messrs. Gellatly, Hankey, Sewell & Co., to whom the Committee are much indebted for giving them every facility for making the experiments. She is a vessel of 214·3 ft. in length between perpendiculars, 29·3 ft. beam, and 20·5 ft. depth. Her registered tonnage is 632 net, and her gross tonnage 994, under deck 899 tons. Her displacement on the day of the trial, when the mean draft was 18 ft. 11¾ in., was ,175 tons.

The trial was made upon the 14th and 15th November, 1888, on a run from Gravesend to Portland. The ship left Gravesend, where her compasses had been adjusted, about six o'clock on the afternoon of the 14th November, and the trial started at 8.51 p.m. on that evening. It lasted until 11.0 a.m. on the 15th. The run was continuous, with the exception of stoppages amounting in all to 12 minutes between 3.10 and 3.25 a.m. when landing the pilot off Dover. In addition to this the engines were running slow for about 13 minutes between 3.0 and 3.30 a.m. The reading of the counter was entered at each change of speed or stoppage during this time.

Engines.—The *Fusi Yama* is fitted with compound surface-condensing engines, made by Mr. Martin Samuelson, of Hull, in the year 1874. They had been thoroughly overhauled by Messrs. Rait & Gardiner, under the superintendence of Mr. Frederick Edwards, immediately before the trial, and were in thoroughly good working order. The cylinders' diameters are 27·35 in., and 50·3 in., measured from gauges. Their common stroke is 33 in. The diameter of both piston-rods is 4.9 in. There are no tail rods.

The cranks are at right angles, the low-pressure leading.

The cylinders are not jacketed. The clearances of the high and low-pressure cylinders as measured on the drawings are respectively 7·6 and 5·0 per cent.

Each cylinder is provided with a single slide-valve worked by the ordinary link-motion gear. The throttle and stop valves, and the link-motion were sealed up at starting. The link-motion, however, was opened out a little at 1.24 a.m., and remained in its new position during the rest of the run. The screw propeller is four-bladed, having a diameter of 13 ft., and a mean pitch of 16·37 ft.

Boilers.—Steam is supplied by one boiler 13 ft. 3¾ in. mean diameter, 11 ft. long, and containing three furnaces. The total grate surface is 52 square feet, and the total heating surface 2,257 square feet, the ratio between the two being 1 to 43·4. The mean diameter of the flues is 2 ft. 11½ in. The fire-bars are of the ordinary description; and there are 17 bars in the width of each furnace, and therefore 34 in each grate. There are 232 tubes of 3¾ in. external diameter, and 7 ft. 5 in. long between plates, equivalent to a total tube surface of 1,689 square feet, which is 32·5 times the grate surface. The internal diameter of the funnel is 4 ft. 6½ in., and its total height is 43 ft. 2 in. above the centre of the lowest furnace.

The total weight of the engines and boiler, including water in condenser pipes and boiler, and all mountings, is about 100 tons. The net volume of the boiler is about 1,681 cubic feet.

Duration of Trial.—The duration of the trial from start to finish was 14 hours 9 minutes. Deducting the 12 minutes of stoppage, the running time was therefore 13 hours 57 minutes, or 837 minutes.

Coal Measurement.—The same method was used for weighing the coal as was employed upon the *Meteor* trial. About 70 lbs. of coal were weighed in each bucket, and about nine buckets were weighed on to the stoke-hold floor at one time. The trial was started with a clean floor. The time was noted at which each lot of weighed coal was put upon the fire, and no more coal was weighed out until the floor was again clear. The fires were not cleaned during the run. The ashes were weighed after the trial was over. The coal was West Hartley Tyne coal, costing 15s. 9d. per ton. It was somewhat irregular in quality, but a sample collected at different times during the run, and afterwards well mixed and pounded, gives the following analysis, which has been made by Mr. C. J. Wilson:—

	Coal as used.		Dry coal.	
Carbon - - - - - -	70·85	per cent.	77·52	per cent.
Hydrogen - - - - -	4·71	,, ,,	5·15	,, ,,
Moisture - - - - -	8·60	,, ,,	0·00	,, ,,
Ash - - - - - -	5·11	,, ,,	5·59	,, ,,
Nitrogen, Sulphur, Oxygen, &c., by difference - -	10·73	,, ,,	11·74	,, ,,
	100·00		100·00	

The calculated calorific value of this fuel as used is 12,760 thermal units per lb., which is equivalent to the evaporation of 13·21 lbs. of water from and at 212° Fahr. The equivalent carbon-value of this fuel as used is 0·878 lbs. per lb. The total coal used was 13,768 lbs. in 849 minutes. As, out of the whole time of running, the engines were stopped for 12 minutes, during which period of course the fires were more or less damped, it may be taken that the actual time of firing was equivalent to about 840 minutes; but in order not to confuse matters the boiler time will be taken as equal to the engine time, that is to say, to the time during which the engines were actually running, namely 837 minutes. The total coal was therefore 16·45 lbs. per minute, or 987 lbs. per hour. The weather was fair until reaching Dover, but became very rough during the last part of the trial, which was brought to an end somewhat sooner than was intended, because of the great difficulty of obtaining further accurate measurements. Up to the actual point of ceasing observations, however, the weather did not affect their accuracy, although it rendered difficult the estimation of the water-level in the boiler at the end of the trial. The roughness of the weather at the end of the trial prevented accurate measurements being made as to the amount of clinker obtained from cleaning the fires. The actual amount of ash weighed off from under the grates was only 278 lbs., or about 2 per cent. of the total weight of the fuel.

Furnace Gases.—The temperature of the chimney gases was observed 15 times during the trial, and its average value was 578° Fahr.; the highest reading being 617°, and the lowest (which was just after starting), 500°. Two samples of furnace gases were collected and analysed; the analyses of these by weight and by volume are given in the following table:—

Percentage Composition of Flue Glasses.

Constituent.	No. 1.		No. 2.		Mean.	
	By Volume	By Weight	By Volume	By Weight	By Volume	By Weight
Carbonic Acid -	6 93	10·30	8·14	12·04	7·53	11·17
Carbonic Oxide -	0 00	0·00	0 00	0·00	0 00	0 00
Oxygen - -	12·14	13·13	11·00	11·84	11·57	12·48
Nitrogen - -	80·93	76·57	80·86	76 12	80·90	76·35
	100 00	100·00	100·00	100 00	100·00	100·00

The mean chimney draft, which was measured by a U gauge-glass at the place where the furnace gases were collected, was 0·28 inch of water.

Feed-water Measurement.—The feed-water was measured in the same way as for the *Meteor*, on its way from the hot-well to the feed-pump of the engine. The tanks used for weighing it (which held about 260 lbs. each) were placed on the upper engine-room platform; their contents were carefully tested by weighing water into them and they were at the same time ascertained to be free from any leakage. The necessary correction having been made for the temperature of the feed, the total water used amounted to 109,800 lbs. (its mean temperature being 129·5° Fahr.), over a total time of 850 minutes. The engine was actually running during 838* minutes of this time, so that the mean consumption of water per minute (engine time) was 131·0 lbs., or 7,860 lbs. per hour.

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* Read at the Meetings of the Institution of Mechanical Engineers.

All the steam made by the boilers went to the main engine, steam being kept up in the donkey boiler for any other purposes that were required.

Power Measurement.—Indicator diagrams were taken at about half hourly intervals throughout the whole of the trial, 26 sets or 104 cards being taken in all. A pair of Darkes' indicators were used on the high-pressure cylinder with $\frac{1}{30}$th springs, and a pair of Richards' indicators on the low-pressure cylinder with $\frac{1}{10}$th springs. The following are the mean effective pressures in the two cylinders in pounds per square inch .—

Cylinder.	Top.	Bottom.	Mean.
High-pressure - - -	31 06	30·41	30 74
Low-pressure - - -	10·43	11·30	10 87

These pressures correspond with the following I.H.P.'s:—

High-pressure cylinder - - - - - -	168·2
Low-pressure - - - - - - - -	203 1
Total Indicated Horse Power - - - - -	371·3

One set of cards was taken during the time when the engines were slowed down (13 minutes), and the proper allowance has been made for this in the preceding averages.

The maximum I.H.P. given by any one set of cards was 402 2, which occurred at 5.30 a.m., with 57·5 revolutions per minute, and 59·0 lbs. of steam. The minimum I.H.P. by any one set of diagrams at full speed was 313·0 at 11.0 p.m., with 53 revolutions per minute, and 49 lbs. of steam. From the 104 diagrams which were taken during the trial a mean diagram has been plotted for each of the two cylinders.

Speed—The counter read 8,507 at 8.51 p.m., when the trial commenced, and 55,033 at 11.0 a.m., when the trial ended. The total number of revolutions made by the engines was therefore 46,526 in a total running time 837 minutes, which gives an average rate of 55·59 revolutions per minute. The maximum number of revolutions per minute for any half-hour was 57·5, and the minimum number (except when slowed down) was 53·0.

Pressures, &c.—The mean barometric pressure during the trial was 30·1 in. of mercury, or 14·8 lbs. per square inch. The mean boiler pressure was 56·84 lbs. per square inch above the atmosphere, measured on the gauge in the stoke-hold. On the engine-room gauge the mean pressure was 55·2 lbs. to the square inch, and the pressure was fairly constant, except during about two hours towards the beginning of the run, and during the time when the engines were slowed down. The pressure-gauge in the stoke-hold was read every quarter of an hour during the trial, and the other gauges were read every half-hour alternately with the counter reading, and at the same time as that at which the indicator cards were taken. The mean reading of the vacuum gauge was 25·40 inch of mercury, or 12·48 lbs per square inch below the atmosphere. The mean initial pressure in the high-pressure cylinder (from measurement of diagrams) was 50·3 lbs. per square inch above the atmosphere; and the mean back-pressure in the low-pressure cylinder was 10·9 lbs. per square inch below the atmosphere, which corresponds to an absolute back-pressure of 3·9 lbs. in the cylinder.

Boiler Efficiencies.—The rate of combustion in the furnaces was 18·98 lbs. of coal per square foot of grate surface per hour, or 0·437 lb. per square foot of total heating surface per hour. The evaporation was at the rate of 7·96 lbs. of water per lb. of coal. As the feed entered the boiler at a temperature of 129·5° Fahr., and as the temperature corresponding to the mean steam pressure was 304° Fahr., each lb. of steam must have taken up 1,077 thermal units; so that the equivalent evaporation from and at 212° Fahr. was 8 87 lbs. of water per lb. of coal, or about 10·10 lbs. per lb. of carbon-value in fuel. The equivalent amount of heat utilised per lb. of coal was 8,570 thermal units, or say 67·2 per cent. of the whole calorific value of the fuel; which percentage therefore represents the actual boiler efficiency.

The total nominal calorific value of the fuel burnt per minute was 209,900 thermal units. Assuming that the two samples of furnace gases analysed gave a fair average value, it appears that the weight of dry air per lb. of coal was about 22·8 lbs. The loss of heat in raising the temperature of the furnace gases from 55° Fahr., allowing for the steam due to the combustion of the hydrogen in the fuel, works out to 2,995 thermal units, or 23·5 per cent. of the whole calorific value of the fuel. There was no loss by formation of carbonic oxide. The loss due to evaporation of the moisture in the fuel would be 0·9 per cent. These quantities add up to 91·6 per cent. of the whole heat of combustion, the balance of 8·4 per cent. including all losses by radiation. The weight of water evaporated per square foot of total heating surface was 3·48 lbs. per hour. The average rate of transmission of heat through the material of the boiler was 3,750 thermal units per square foot of total heating surface per hour.

Coal Consumption.—The total coal burnt, namely 987 lbs. per hour, corresponds to 2·66 lbs. per I.H.P. per hour. This is equivalent to 2·33 lbs. of carbon-value per I.H.P. per hour.

Engine Efficiencies.—The measurement of feed-water shows that the quantity used per I.H P. per hour was 21·17 lbs. per hour. The actual heat received by the feed-water per minute was 141,100 thermal units, or 380 thermal units per I.H.P. per minute, which is 67 2 per cent. of the whole heat of combustion. The absolute engine efficiency, or ratio of the heat turned into work to the total heat received by the feed-water, was 11·25 per cent.

Total Efficiency.—The combined efficiency of the boiler and engines, or the ratio of the heat turned into work to the total heat of combustion of the fuel, was 0·672 x 0·1125, which is equivalent to 7·6 per cent.

Steam from Indicator Diagrams.—The following are the results of measurements made upon all the indicator diagrams taken to ascertain the proportion of steam accounted for by them. The actual weight of feed-water used per revolution was 2·357 lbs. :—

Proportion of Steam accounted for by indicator diagrams.	Lbs. per Revolution.	Percentage of Total Feed.	Percentage present in cylinder as water.
	Lbs.	Per cent.	Per cent.
Steam present in high-pressure cylinder after cut-off, when the pressure was 45 2 lbs. per square inch above the atmosphere - -	2 08	88·2	11·8
Steam present in low-pressure cylinder near end of expansion, when the pressure was 4·8 lbs. per square inch below the atmosphere	1·66	70 7	29 3

2. TRIAL OF THE S.S. "COLCHESTER."

Steamer.—This vessel is the latest of those built for the Great Eastern Railway Co., for carrying their passenger traffic between Harwich and Antwerp. The Committee is very greatly indebted to the Great Eastern Railway Co., and especially to Mr. Holden, the locomotive superintendent of the line, and to Captain Howard, the company's marine superintendent, for the facilities which they gave throughout for the carrying on of the trial. The *Colchester*, which is driven by twin screws, is a vessel of 281 ft. in length, 31 ft. beam, and 15·2 ft. in depth. Her gross registered tonnage is 1,160, her net registered tonnage being only 517 tons; the remainder of 643 tons representing space occupied by machinery, seamen, &c. Her draft at Harwich at the end of the trial was 13 ft. 7 in. aft, and 10 ft. 6 in. forward; corresponding to a displacement of 1,675 tons.

The trial was made upon the 9th November, 1889, on a run from the Humber to Harwich. The ship had been lying in the Humber, where her machinery had received a thorough overhauling by the makers, Messrs. Earle's Shipbuilding and Engineering Co., Hull. Steam was got up on the morning of the 8th November, and the engines were turned round about 3 p.m. on that day. The steamer left her moorings about 3 a.m. on the 9th November, and the trial started at 5 a.m. on that morning. It lasted until 4 p.m. exactly, the boat being taken a little south of the Stour estuary in order to prolong the trial somewhat. The furthest south point was reached at 3 p.m. on 9th November. The engines were stopped about seven minutes during this time to allow the pilot to leave the ship, and they were also slowed down for five minutes about the same time. The counter was read at each of these changes of speed, all of which occurred before 5.40 a.m.

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* The last feed-tank was emptied at 11.1 a.m., or one minute after the last reading of the counter.

Engines.—The *Colchester* is fitted with two compound surface-condensing engines, driving the two screw shafts. The engines are entirely separate, and are placed slightly inclining from the vertical, the space between them being taken up by a condenser which is common to the two. They were built by Earle's Shipbuilding and Engineering Co. in 1888-89. The vessel had been on her station running to Antwerp and back twice every week from the end of February to the middle of September, 1889, and had run a total distance of about 16,530 miles during that time; and had undergone her first overhaul at the makers, as already mentioned, during the week before the trial. The engines and boilers therefore were in thoroughly good order. The diameter of the cylinders are 30 in. and 57 in. respectively. An opportunity has not occurred to gauge them. Their common stroke is 36 in. The diameter of all piston rods is 6·0 inches, and of all tail rods 4·5 inches. The cranks of each engine are at right angles, and the high-pressure cranks lead. The cylinders are not jacketed. The clearances of the high and low-pressure cylinders as given by the owners are 9·39 and 6·23 per cent.

The valve gear is of the ordinary link motion type. The surface-condenser contains 3,000 square feet of tube surface in 1,176 tubes, 1 in. external diameter, and 9 ft. 11¾ in. long over plates. The screw propellers have cast-steel blades and boss; each is 11 ft. 6 in. diameter, and 20 ft. 4½ in. pitch, with a surface of 45½ square feet.

Boilers.—There are two iron boilers, each double-ended, 13 ft. mean diameter, and 18 ft. 3 in. long; each boiler having six furnaces of 3 ft. 4 in. internal diameter. The total grate surface is 220 square feet; the length of each surface on bars being 5 ft. 6 in. The total heating surface is 5,820 square feet, of which 4,770 square feet is tube surface. There are 784 tubes, 3¼ in. external diameter, and 6 ft. 9 in. long over plates. The total heating surface is therefore 26·5 times, and the tube surface 21·7 times the grate surface. The boilers have been designed to work safely with a pressure of 90 lbs. of steam, but are ordinarily worked, as during the trial, with a pressure from 5 to 10 lbs. less. There are two double funnels, one for each stoke-hold; the internal diameters of their outer and inner shells are respectively 6 ft. 7 in., and 5 ft. 5 in., and the total height of each funnel is 47 ft. above the centre of the wing furnaces.

The total weight of the engines and boilers, including water in condenser, pipes, and boilers, and all mountings, is about 395 tons. The net volume of the boilers is about 4,980 cubic feet.

Duration of Trial.—The duration of trial from start to finish was 11 hours exactly. Deducting the 7 minutes of stop, the running time was therefore 10 hours 53 minutes, or 653 minutes.

Coal Measurement.—The coal was weighed in each stoke-hold by spring balances as before. From 500 to 700 lbs. of coal was put down at one time on each side of each stoke-hold. The trial was started with clean floors in each stoke-hold. The time was noted at which each lot of weighed coal was put upon the fire, and no more coal was weighed out until the floor was again clear. The fires were not cleaned during the run. The ashes were weighed after the trial was over; but the weight of the ashes given below includes the ash formed while steam was being raised during the time the fires were banked up before the start, and during the two hours' run before the trial actually commenced. The fire-grates were fitted with Henderson's fire-bars, with the object mainly of rendering possible a somewhat large rate of combustion, so as to get the greatest possible duty out of the boilers. The coal used in the forward stoke-hold, and during the first half of the run in the after stoke-hold, was Monk Bretton (Yorkshire) coal. For the second half of the run a mixed coal, chiefly Hucknall and Shireoaks (Nottinghamshire), was used in the after stoke-hold. Coal samples were taken frequently during the run from both stoke-holds, and mixed together, and finally pounded; so as to obtain as representative a sample as possible for analysis. The analysis was made as before by Mr. C. J. Wilson, who gives it as follows:—

	Coal as used.	Dry Coal.
Carbon - - - - -	71 89 per cent.	75·08 per cent.
Hydrogen - - - - -	5·42 ,, ,,	5·66 ,, ,,
Moisture - - - - -	4·25 ,, ,,	0·00 ,, ,,
Ash - - - - - -	4 08 ,, ,,	4 26 ,, ,,
Nitrogen, Sulphur, Oxygen, &c., by difference - -	14·36 ,, ,,	15 00 ,, ,,
	100 00	100 00

The following is an analysis made by Mr. Wilson of a sample of the clinker and ash:—

Less on ignition (= Carbon) - -	43·73 per cent.
Mineral matter - - - - -	56·27 ,, ,,
	100·00

The ash therefore contained about 43·7 per cent. of carbon.

The calculated calorific value of the fuel as used is 13,280 thermal units, which corresponds to the evaporation of 13·75 lbs. of water from and at 212° Fahr. The equivalent carbon-value of 1 lb. of the fuel as used is 09·13 lbs. The total coal used was as follows:—

After stoke-hold, port side - - -	16,020 lbs.
,, ,, starboard side - -	15,426 ,,
Forward ,, port side - - -	15,509 ,,
,, ,, starboard side - -	15,536 ,,
	62,491 lbs.

This amounts to 95·7 lbs. per minute, or 5,742 lbs. per hour, taking the running time of 653 minutes. As a check upon the coal consumption it has also been worked out from a time after the stoppage, at about 5.40 a.m., to the end of the trial; and over this period it comes to 95·9 lbs. per minute, that is to say the same as before within the limits of measurement.

The weather was very fine during the whole of the trial, but a little foggy towards the end; which made the captain of the steamer reluctant to continue the run longer, as it was originally intended to do.

The actual amount of clinker and ash weighed off under the conditions already mentioned, was 2,890 lbs. It may be taken roughly that this quantity, 2,200 lbs., or 200 lbs. per hour, was made during the actual run, which is about 3½ per cent. of the total quantity of coal.

Furnace Gases.—A sample of the furnace gases was collected over mercury by Mr. Wilson each hour from each funnel, there being 20 samples in all. The analyses of these samples are given in Table 3. This set of analyses and the corresponding set for the *Tartar* trial, are perhaps the most important and complete which have ever been made under such conditions, and merit very close examination. The "mean" figures in the table show that 3·8 per cent. by weight of the dry furnace gases is carbon, from which it follows that, allowing for the combustion of the hydrogen of the fuel, 18·5 lbs. of dry air passed through the furnace per pound of coal burnt.

TABLE 3.

"Colchester" Trial.

Analyses of Funnel Gases by Volume.

	No. of Sample.	Carbonic Acid.	Carbonic Oxide.	Oxygen.	Nitrogen.
		Per cent.	Per cent.	Per cent.	Per cent.
FORWARD FUNNEL.	1	8·13	0·00	11·20	80·67
	3	10 55	1·84	6 59	81·02
	5	12·47	0 00	6 43	81·10
	7	7·98	0 00	11·79	80·23
	9	12·37	1 64	5·39	80·60
	11	9·89	0 00	9·72	80·39
	13	11·18	0·00	8 30	80 52
	15	10·60	0·00	9 17	80·23
	17	11·80	0·00	6·45	81·75
	19	11·27	0 00	7·67	81·06
	Mean	10·62	0·35	8·27	80·76
AFTER FUNNEL.	2	7 75	0 00	11.27	80·98
	4	8 93	0·00	10·66	80·41
	6	8·72	0·00	11 21	80·07
	8	6·18	0·00	13·46	80·36
	10	6 33	0·00	13·69	79·98
	12	3·01	0·00	17·66	79 33
	14	9 97	0·00	9·72	80·31
	16	12·08	1·15	5·90	80·87
	18	9·90	0·00	10·37	79·73
	20	5·94	0 00	14·09	79·97
	Mean	7·88	0·12	11·80	80·20
Mean of Both Funnels.		9·25	0·23	10·04	80·48

"COLCHESTER" TRIAL.

Analyses of Funnel Gases by Weight.

No. of Sample.	Carbonic Acid.	Carbonic Oxide.	Oxygen.	Nitrogen.	Time of Collecting.
	Per cent.	Per cent.	Per cent.	Per cent.	
1	12·02	0·00	12·05	75·93	5.20 a.m.
3	15·50	1·72	7·04	75·74	6.20 ,,
5	18·14	0·00	6·80	75·06	7 20 ,,
7	11·80	0·00	12·68	75·52	8.25 ,,
9	18·03	1·52	5·71	74·74	9.40 ,,
11	14·52	0·00	10·38	75·10	10.40 ,,
13	16·33	0·00	8·82	74·85	11.40 ,,
15	15·52	0·00	9·76	74·72	12.40 p.m.
17	17·22	0·00	6·85	75·93	2.5 ,,
19	16·47	0·00	8·15	75 38	3.5 ,,
Mean	15·56	0·32	8·82	75·30	
2	11·48	0·00	12·15	76·37	5.50 a.m.
4	13·16	0·00	11·43	75·41	6 50 ,,
6	12·86	0·00	12·02	75·12	7.55 ,,
8	9·21	0·00	14·59	76·20	9.10 ,,
10	9·42	0·00	14·82	75·76	10.10 ,,
12	4·54	0·00	19·36	76·10	11.10 ,,
14	14·63	0·00	10·37	75·00	12 10 p.m.
16	17·62	1·07	6·26	75·05	1.35 ,,
18	14·52	0·00	11·06	74·42	2.35 ,,
20	8·85	0·00	15·28	75·87	3.35 ,,
Mean.	11·63	0·11	12·73	75·53	
Mean of Both Funnels.	13·59	0·22	10·78	75·41	

The chimney temperatures were read in each funnel every quarter of an hour during the whole of the trial, from a mercury thermometer containing compressed nitrogen over the mercury. This thermometer reads up to 860° Fahr., but in a very large number of cases (about ⅞ths of the whole) the temperature rose somewhat above the maximum reading of the thermometer. It was obvious from the motion of the mercury that the true temperature was not much above the limit of the thermometer, but of course its exact value is unknown. Assuming that the mean value of these readings was 20° Fahr. above the limit of the thermometer, or 880° Fahr. (which is probably true within an error of 10° either way), the mean temperature in the forward funnel was 828° Fahr., and in the after funnel 842° Fahr., the mean of both being therefore 835° Fahr.

The mean chimney draft measured by U gauges was 0·38 in. of water in the forward, and 0·34 in. in the after funnel.

Feed-Water Measurement.—The feed-water was measured in two tanks. These tanks have been made specially for feed measurement, in a form as adaptable as possible to the conditions of various steamers; and in parts of such a size that they can be readily got down into the engine-room of a steamer, and erected and jointed there. It was found possible to put them together in an extremely confined space in the *Colchester*, and again in the *Tartar* at a somewhat later date. Each tank held about 2,200 lbs. of water at 64° Fahr., between the upper and the lower cocks. Their contents were carefully tested by weighing water into them when jointed and connected, before placing them on board the steamer. Each tank lasted in the *Colchester* about three minutes. The total amount of water used was 468,845 lbs., over a total running time of 654 minutes.* This amounts to 717 lbs. per minute, or 43,020 lbs. per hour, the mean temperature of the feed being 113° Fahr. The feed-pump of one of the engines only was employed to pump throughout, the other pump not being used. All the steam made by the [illegible] went to the main engines; the steam for the circulating [illegible]ne, the steering engine, and dynamo engine, and any steam for heating that was required, was taken from the donkey boiler, to which special steam connections were made for the purpose. The water-level was practically the same at the beginning and end of the trial.

Power Measurement.—Indicator diagrams were taken every half-hour from each engine. There were thus 22 sets of diagrams, or 176 single cards, taken in all. The six indicators used were all made by Messrs. T. S. M'Innes and Cairns, of Glasgow, and kindly lent by them to the Committee. These indicators are very simple in construction and handy in use, and their vulcanite sheathing is attended, at sea especially, with much convenience in manipulation. The following are the mean effective pressures in the cylinders in lbs. per square inch:—

Cylinder.	Top.	Bottom.	Mean.
Port; high-pressure - -	43 34	47·96	45 65
,, low-pressure - -	13·25	13·58	13·42
Starboard; high pressure -	38·45	45 68	42·07
,, low-pressure -	11·68	13·15	12·42

These pressures correspond to the following I.H.P.'s:—

Port engine, high-pressure cylinder -	490 3	
,, ,, low-pressure cylinder -	532 2	
		1,022 5
Starboard engine; high-pressure cylinder	457·9	
,, ,, low-pressure cylinder	499·3	
		957·2
Total Indicated Horse-Power - - -		1,979·7

The maximum I.H.P. given by any one set of cards is 2,194·2, which occurred at 10.15 a.m., with a mean speed of 88·6 revolutions per minute, and 86 lbs. of steam. The minimum I.H.P. by any one set of cards was 1,699·6, at 5.45 p.m., with a mean speed of 83·2 revolutions per minute, and 73 lbs. of steam. From the 176 diagrams which were taken during the trial, two mean diagrams have been plotted, one for the two high-pressure and one for the two low-pressure cylinders.

Speed.—The counters for the two engines were entirely separate. The total number of revolutions made by the port engine was 56,136, and the total number of revolutions made by the starboard engine was 56,857; which totals correspond respectively to 86·0 and 87·1 revolutions per minute. The maximum number of revolutions per minute for any half-hour was 89·9 for the port, and 91·7 for the starboard engine;[1] and the minimum number, except when slowed down, was 82·9 for the port, and 84·0 for the starboard engine.

Pressures, &c.—The mean barometric pressure during the trial was 30·6 inches of mercury, or 15·0 lbs. per square inch. The mean boiler pressure was 80·5 lbs. per square inch by the pressure-gauge in the stoke-hold, and 78 2 lbs. per square inch by the pressure-gauge in the engine-room. The mean vacuum by gauge was 25·4 inch of mercury, corresponding to 2·5 lbs. per square inch of absolute back-pressure. The mean pressure in the receiver of the starboard engine was 8·0 lbs. per square inch above the atmosphere, and that of the port engine 8·8 lbs. per square inch above the atmosphere. The mean initial pressures in the high-pressure cylinders were 64·3 lbs. per square inch above the atmosphere in the port engine, and 59 4 lbs. in the starboard engine. The mean back-pressures in the low-pressure cylinders were respectively 4·4 and 4·5 lbs. per square inch absolute.

Boiler Efficiencies.—The mean rate of combustion in the furnaces was 26·1 lbs. of coal per square foot of grate surface per hour, or 0·987 lb. per square foot of total heating surface per hour. The evaporation was at the rate of 7·49 lbs. of water per lb. of coal. The feed entered the boiler at a temperature of 113° Fahr., and the temperature corresponding to the mean boiler pressure was 324° Fahr., so that each lb. of steam must have taken up 1,100 thermal units; hence the equivalent evaporation from and at 212° Fahr. was 8·53 lbs. of water per lb. of coal, or about 9·34 lbs. per lb. of carbon-value in fuel. The equivalent amount of heat utilized per lb. of coal was 8,240 thermal units, or say 62·0 per cent. of the whole calorific value of the fuel, which percentage therefore represents the actual boiler efficiency.

The total calculated calorific value of the fuel burnt per minute was 1,271,000 thermal units.

[illegible] last feed tank was finished at 4.4 p.m. instead of 4 p.m.

The weight of dry air per lb. of coal, calculated from the furnace gas analyses, works out to 18·5 lbs., so that the total weight of furnace gases per pound of coal would be about 19·4 lbs. Their specific heat may be taken as 0·238, and they have been raised in temperature from say 55° Fahr., the temperature of the outer air, to 835° Fahr., the temperature of the chimney gases. This corresponds to a loss of 3,714 thermal units per lb. of coal, or 28·0 per cent. of the whole calorific value of the fuel, including the raising through the same range of temperature of the steam formed by the combustion of the hydrogen in the fuel. The loss due to the evaporation of the moisture in the fuel works out to 0·4 per cent., and that due to imperfect combustion to 1·3 per cent. These quantities add up to 91·7 per cent. of the whole heat of combustion, leaving a balance of 8·3 per cent., which includes all losses by radiation unaccounted for. The weight of water evaporated from and at 212° Fahr. per square foot of total heating surface was 8·42 lbs. per hour.

The average rate of transmission of heat through the material of the boiler was 8,130 thermal units per square foot of heating surface per hour.

Coal Consumption.—The total coal burnt, namely 5,742 lbs. per hour, corresponds to 2·90 lbs. per I.H.P. per hour. This is equivalent to 2·65 lbs. of carbon-value per I.H.P. per hour.

Engine Efficiencies.—The total I.H.P. being 1,980, and the total feed-water used per hour being 43,020 lbs., the feed-water used per I.H.P. per hour was 21·73 lbs. The actual heat received by the feed-water per minute was 788,700 thermal units, or 398·4 thermal units per I.H.P. per minute; which is 62 per cent. of the whole heat of combustion. The absolute engine efficiency was 10·7 per cent.

Total Efficiency.—The combined efficiency of the boilers and engines, or ratio of the heat turned into work to the total heat of combustion of the fuel, was 0·62 x 0·107, which is equivalent to 6·6 per cent.

Steam from Indicator Diagrams.—The following are the results of measurements made upon the indicator diagrams taken to ascertain the proportion of steam accounted for by them. The actual weight of feed-water used per revolution was 8·28 lbs.:—

Proportion of Steam accounted for by indicator diagrams.	Lbs. per Revolution.	Percentage of Total Feed.	Percentage present in cylinder as water.
	Lbs.	Per cent.	Per cent.
Steam present in high-pressure cylinder, port engine, after cut-off, when the pressure was 51 lbs. per square inch above the atmosphere - - -	3·11	71·7	28 3
Steam present in high-pressure cylinder, starboard engine, after cut-off, when the pressure was 51 lbs. per square inch above the atmosphere - - -	2·83		
Steam present in low-pressure cylinder, port engine, near end of expansion, when the pressure was 7 lbs. per square inch below the atmosphere - -	2·19	53·0	47·0
Steam present in low-pressure cylinder, starboard engine, near end of expansion, when the pressure was 7 lbs. per square inch below the atmosphere -	2·20		

Speed of Vessel.—The following notes from the log book of the ship may be of interest:—

	Time.	Distance in Nautical miles.
Left Hull Roads - - -	3.15 a.m.	0
Spurn Light - - - -	4.40	24
Dudgeon ,, - - - -	7.45	54
Cromer ,, - - - -	9 5	75¼
Cockle ,, - - - -	10.35	97
Corten Light - - - -	11.15	108
Shipwash ,, - - - -	1.25 p.m.	140
Sunk ,, - - - -	2.20	151
Long Sand Head Light - -	2 40	158½
Cork Light - - - .	4.0	173
Parkeston Quay - - - -	4.35	178½

The mean speed between Dudgeon and Cork Lights, which includes nearly the whole of the trial except that portion when the vessel was slowed down and stopped, was therefore 14·4 knots.

The *Colchester* is a vessel built rather to attain a maximum of power and speed over a short journey than a maximum of economy. Looked at from this point of view, it may be interesting to compare the relation between power developed and the size of the machinery in her case, and in those of the other steamers tested. The net volume of her boilers is about 4,980 cubic feet, or at a rate of 2·5 cubic feet per I.H.P. This ratio in the case of the *Meteor*, *Fusi Yama*, and *Tartar*, is respectively, 2·7, 4·53 and 4·34 cubic feet per I.H.P.

3. Trial of the s.s. "Tartar."

Steamer.—This s.s. is owned by Messrs. Gellatly, Hankey, Sewell & Co., and is an excellent example of modern economical engines in a cargo-carrying steamer. She was built in the year 1887 by Messrs. R. Dixon & Co., of Middlesborough, and engined by Messrs. Thomas Richardson & Son, of Hartlepool, with triple-expansion engines, working a single screw. She is a vessel of 332 ft. in length, 38 ft. in breadth, and 27 ft. in depth (moulded). Her gross registered tonnage is 2,389, and she is classed at Lloyd's 100 A1. Her draft during the trial was 8 ft. 6 in. forward, and 15 ft. 6 in. aft, or 12 ft. mean; and her displacement at this draft was 2,250 tons. She was practically without cargo, carrying nothing but water ballast.

The trial was made upon the 27th of November, 1889, on a run from the Thames to Portland. The vessel had arrived in London on the 21st of November after a voyage from Australia; and the boilers were cleaned, and the engines opened out, and overhauled before the trial, while the ship was unloading in the docks. Steam was got up on the evening of the 26th November, and the vessel went out of dock about 5 a.m. on the 27th. The trial started at 8.25 a.m. as soon as the vessel was far enough down the Thames to run at full speed, and lasted until 6.30 p.m. The weather during the last part of the run was sufficiently rough to cause the engines to race a little, in consequence of the light draft of the ship. At the time mentioned (6.30 p.m.) the weather had become sufficiently bad to make the taking of accurate observations a matter of considerable difficulty, and it was therefore decided to end the trial, rather than to run any risk of having it spoilt by inaccuracies. In consequence of snowstorms met with going down the Channel, the engines were slowed from 9.52 a.m. to 10.56 a.m., and again for 11 minutes between 12 and 1 o'clock. During these periods the speed was about 64 revolutions per minute, the full speed at other times being about 71 revolutions per minute. Diagrams were taken at the slower speeds, so that they are properly allowed for in the averages. The engines were not stopped at all during the trial; and, with the exception of the intervals named, ran under constant conditions as to position of valve-gear, &c., namely, with the main stop-valve and the throttle-valve fully open, and the link motion slightly linked up.

Engines.—The *Tartar* is fitted with triple-expansion surface-condensing engines, the cylinders being placed in the order, high, low, intermediate, going from forward to aft. The cranks are placed in the sequence—high, low, intermediate. The diameters of the cylinders are 26·03 in., 42·03 in., and 68·95 in., by gauges. The piston-rods are all 5·5 in. diameter. There are no tail rods. The stroke of all three cylinders is 3 ft. 6 in. The cylinders are jacketed, and there is a separate steam-admission pipe to each jacket. The clearances of the cylinders are given by the makers as 14·51, and 9·25, and 5·10 per cent. The valve-gear is of the link-motion type, with an independent adjustment for the cut-off. The surface-condenser contains 2,250 square feet of tube surface, in 876 tubes of ¾ in. external diameter and of 13 ft. 0⅝ in. length between tube-plates. The screw propeller has four blades, and is 16 ft. 6 in. diameter, with a pitch of 18 ft.

Boilers.—Steam is supplied by two double-ended steel boilers with Fox's flues, designed to work at a pressure of 150 lbs. per square inch. The boilers are 13 ft. in mean diameter, and 14 ft. 9 in. long, each with two furnaces at each end, there being eight furnaces in all. The total grate surface is 161 square feet, each grate being 5 ft. 6 in. in length, and 3 ft. 8 in. broad. The total heating surface is 5,226 square feet, of which 4,366 square feet is tube surface. The total heating surface is therefore 32·5 times, and the tube surface 27·1 times the grate surface. There are 992 tubes, 3 in. diameter outside, and 5 ft. 9 in. long over plates. The internal diameter of the funnel is 7 ft., and its total height 57 ft. above the centre of the furnaces.

The total weight of the engines and boilers, including water in condenser, pipes and boilers, and all mountings, is about 191 tons. The net volume of the boilers is about 4,710 cubic feet.

Duration of Trial.—The duration of the trial from start to finish was 10 hours 5 minutes, or 605 minutes.

Coal Measurement.—The coal was weighed as in the other cases, from 500 to 600 lbs. at a time being put down on each side of each stoke-hold. The trial was started with clean floors, and the time of first stoking from each weighed lot of coal was noted, as well as the time when the whole of the weighed coal was finished. The fires were not cleaned during the run. The ashes were weighed after the trial was over, the ash-pits having been cleaned a little time after it commenced. The coal used was Welsh Penrikyber (Glamorganshire) throughout. Coal samples were taken frequently during the run from both stoke-holds, and the final analysis, after a thorough mixture of all these samples, is as follows:—

	Coal as used.	Dry Coal.
Carbon - - - - - -	87·98 per cent.	88·93 per cent.
Hydrogen - - - - -	4·22 ,, ,,	4·26 ,, ,,
Moisture - - - - -	1·07 ,, ,,	0·00 ,, ,,
Ash - - - - - -	3·42 ,, ,,	3·46 ,, ,,
Nitrogen, Sulphur, Oxygen, &c., by difference -	3·31 ,, ,,	3·35 ,, ,,
	100·00	100·00

A sample of the ash was also collected, and has been analysed by Mr. Wilson as follows:—

Loss on ignition (Carbon) - -	65·53 per cent.
Mineral matter - - - - - -	34·47 ,, ,,
	100·00

The calculated calorific value of the fuel is 14,995 thermal units, which corresponds to the evaporation of 15·52 lbs. of water from and at 212° Fahr., and to an equivalent carbon value of 1·031 lbs. per lb. The total coal used was as follows:—

After stoke-hold,	port side	- - -	5,322 lbs.
,, ,,	starboard side	- - -	5,052 ,,
Forward ,,	port side	- - -	4,701 ,,
,, ,,	starboard side	- - -	4,162 ,,
			19,237 ,,

This amounts to 31·8 lbs. per minute, or 1,908 lbs. per hour. As a check upon this consumption, and in order to see how far it might be affected by any irregularities in measurement at the end of the trial, the consumption has also been worked out over a time (in average 560 minutes) at the beginning and end of which the condition of the stoke-hold floors, and of the fires, was identical, and for this interval the coal consumption works out to 32·08 lbs. per minute. It has been thought wise to assume therefore that the actual coal consumption was 32·0 lbs. per minute, or 1,920 lbs. per hour: the small difference between this and the foregoing figures being probably caused by the increasing difficulty of measurement at the very end of the trial. The total amount of ash taken from the two stoke-holds at the end of the trial was 291 lbs., but the ash-pits were not cleaned out until some little time after the trial commenced, so that this weight corresponds only to a period of 6 hours 53 minutes. The ash was therefore equivalent to 0·70 lbs. per minute, or 42 lbs. per hour; which is 2·2 per cent. of the total weight of the fuel put on the bars.

Furnace Gases.—A very complete series of furnace gas samples was collected, a sample being collected over mercury by Mr. Wilson every half-hour. The analyses of these samples are given in Table 4.

TABLE 4.

"TARTAR" TRIAL.

Analyses of Funnel Gases by Volume.

No. of Sample.	Carbonic Acid.	Carbonic Oxide.	Oxygen.	Nitrogen.	Time of Collecting.
	Per cent.	Per cent.	Per cent.	Per cent.	
1	7·28	0·00	12·45	80·27	8.30 a.m.
2	7·61	0·00	11·88	80·51	9.0 ,,
3	8·22	0·00	11·38	80·40	9.30 ,,
4	6·97	0·00	13·20	79·83	10.0 ,,
5	5·91	0·00	14·32	79·77	10.30 ,,
6	6·24	0·00	13·38	80·38	11.0 ,,
7	6·94	0·00	13·10	79·96	11.30 ,,
8	6·44	0·00	13·80	79·76	12 noon.
9	7·70	0·00	12·10	80·20	12.30 p.m.
10	6·21	0·00	13·57	80·22	1.0 ,,
11	8·24	0·00	12·00	79·76	1.30 ,,
12	5·62	0·00	14·40	79·98	2.0 ,,
13	6·29	0·00	13·15	80·56	2.30 ,,
14	6·79	0·00	12·78	80·43	3.0 ,,
15	6·80	0·00	13·30	79·90	3.30 ,,
16	6·54	0·00	12·71	80·75	4.0 ,,
17	6·95	0·00	13·10	79·95	4.30 ,,
18	6·03	0·00	13·08	80·89	5.0 ,,
19	6·67	0·00	13·17	80·16	5.30 ,,
20	6·61	0·00	13·52	79·87	6.0 ,,
21	5·00	0·00	15·27	79·73	6.30 ,,
Mean	6·72	0·00	13·12	80·16	

"TARTAR" TRIAL.

Analyses of Funnel Gases by Weight.

No. of Sample.	Carbonic Acid.	Carbonic Oxide.	Oxygen.	Nitrogen.	Time of Collecting.
	Per cent.	Per cent.	Per cent.	Per cent.	
1	10·80	0·00	13·43	75·77	8.30 a.m.
2	11·28	0·00	12·80	75·92	9.0 ,,
3	12·15	0·00	12·23	75·62	9.30 ,,
4	10·34	0·00	14·25	75·41	10.0 ,,
5	8·81	0·00	15·52	75·67	10.30 ,,
6	9·30	0·00	14·50	76·20	11.0 ,,
7	10·30	0·00	14·15	75·55	11.30 ,,
8	9·58	0·00	14·93	75·49	12 noon.
9	11·40	0·00	13·03	75·57	12.30 p.m.
10	9·25	0·00	14·70	76·05	1.0 ,,
11	12·17	0·00	12·89	74·94	1.30 ,,
12	8·39	0·00	15·63	75·98	2.0 ,,
13	9·37	0·00	14·25	76·38	2.30 ,,
14	10·09	0·00	13·82	76·09	3.0 ,,
15	10·10	0·00	14·37	75·53	3.30 ,,
16	9·74	0·00	13·76	76·50	4.0 ,,
17	10·32	0·00	14·14	75·54	4.30 ,,
18	9·00	0·00	14·19	76·81	5.0 ,,
19	9·92	0·00	14·24	75·84	5.30 ,,
20	9·83	0·00	14·61	75·56	6.0 ,,
21	7·48	0·00	16·61	75·91	6.30 ,,
Mean	9·98	0·00	14·19	75·83	

The chimney temperatures were read every quarter of an hour throughout the trial from a mercury thermometer as before. The average reading was 477° Fahr. It remained very fairly constant during the whole trial.

The chimney draft was read on a U gauge at the same time that the temperature was taken, and varied from $\frac{3}{16}$ in. to $\frac{1}{4}$ in. of water.

Feed-Water Measurement.—The feed-water was measured in the same tanks used for the *Colchester*. Each tank lasted in this case from 5 to 6 minutes. The total amount of water used was 217,430 lbs., over a total time of 605 minutes. This amounts to 359·4 lbs. per minute, or 21,564 lbs. per hour, but reasons are given later on for supposing that a considerable percentage of this quantity was not actually turned into steam. At first pumping was carried out by one of the feed-pumps of the engine, but for the last four hours a donkey-pump was used, as it was found to give much less trouble, and to be much more conveniently under control. The steam for this donkey-pump was supplied from the main boilers. The steam made by the boilers all went to the main engines, steam being kept up in the donkey boiler for all auxiliary engines; and the pipes and connections having been carefully examined, in order to see that no unintentional communications existed. The water-level in the boilers was, on the average, 1½ in. lower at the finish than at the start of the trial. This corresponds to a total of 1,874 lbs. of water, or about 0·86 per cent. of the whole feed; this amount has been added to the quantities given above. It may be interesting to notice that an error of half-an-inch in reading the level in one boiler in a case like this would make a difference of about 375 lbs., or under 0·2 per cent. of the water used.

Power Measurement.—Indicator diagrams were taken every half-hour from each end of each cylinder as before. There were thus 21 complete sets of diagrams, or 126 single cards taken in all. The indicators used were those lent by Messrs. M'Innes and Cairns, which were used also for the *Colchester*. The following are the mean effective pressures in the cylinders in lbs. per square inch:—

Cylinder.	Top.	Bottom.	Mean.
High-pressure - - -	35·74	38·04	36·89
Intermediate - - -	19·92	20·23	20·07
Low-pressure - - -	7·19	7·18	7·18

These pressures correspond to the following I.H.P.'s:—

High-pressure cylinder - - - - -	283·7
Intermediate cylinder - - - - -	408·5
Low-pressure cylinder - - - - -	395·2
Total Indicated Horse Power - - - -	1,087·4

The maximum I.H.P. given by any one set of cards was 1,296·7, which occurred at 8.45 a.m., with 73·2 revolutions per minute, and 146 lbs. of steam. The minimum I.H.P. by any one set of cards was 719·3, at 10.10 a.m., with 61·4 revolutions per minute, and 135 lbs. of steam. From the 126 diagrams which were taken during the trial, a mean diagram has been plotted for each of the three cylinders.

Speed.—The counter was read every quarter of an hour. The total number of revolutions made was 42,350 in 605 minutes, or exactly 70 revolutions per minute. The maximum number of revolutions per minute for any quarter of an hour at full speed was 73·8; and the minimum, 70·3 revolutions per minute; while the average speed during the time that the engine was slowed down was 63·7 revolutions per minute.

Steam Jackets.—As has been already mentioned, each jacket received steam through a separate valve. The connections from the jacket-drains to the hot-well were broken, and all three jackets were made to drain into a small tank placed at the back of the engine; and the rate at which the jacket-water collected in this tank was measured 14 times during the trial, on most occasions for nearly a quarter of an hour continuously. The water collected in this way amounted in all to 2,476 lbs. in 175 minutes, or 14·15 lbs. per minute, which is 3·94 per cent. of the total feed. This quantity is of course included in the total feed measured through the tanks. It was not possible to jacket the high-pressure cylinder with steam of full boiler pressure; and under these circumstances it did not appear advisable to allow any steam to pass into that jacket, which was accordingly shut off. The quantity of steam given is therefore from the intermediate and low-pressure cylinder jackets only.

Pressures, &c.—The mean barometric pressure during the trial was 29·6 ins. of mercury, or 14·6 lbs. per square in. The mean boiler pressure was 143·6 lbs. per square inch by the pressure gauge in the stoke-hold, and 140·4 by that at the engine. The pressures in the high-pressure, intermediate, and low-pressure valve-chests, were respectively 131·4, 46·1, and 3·8 lbs per square inch above the atmosphere respectively. The pressures in the steam-jackets of the intermediate and low-pressure cylinders were 52·5 and 14·0 lbs. per square inch respectively. The cock admitting steam into the high-pressure jacket, although nominally shut, allowed enough steam to leak through to enable the gauge to show pressures varying from 0 to over 50 lbs. per square in. The actual amount of water coming from the high-pressure jacket-drain, however, was too small to affect appreciably the quantities given in the last paragraph. The mean vacuum was 26·2 in. of mercury by gauge, which corresponds to a mean absolute back-pressure in the condenser of 1·7 lbs. per square inch. The mean initial pressure in the high-pressure cylinder was 121·8 lbs. per square in. above the atmosphere; and the mean back pressure in the low-pressure cylinder was 10·5 lbs. per square inch below the atmosphere, which corresponds to an absolute back pressure of 4·1 lbs. per square inch in the cylinder.

Boiler Efficiencies.—The mean rate of combustion in the furnaces was 11·93 lbs. of coal per square foot of grate surface per hour, or 0·367 lbs. per square foot of total heating surface per hour. The total amount of feed-water pumped into the boilers was at the rate of 11·23 lbs. per lb. of coal. As the feed entered the boiler at an average temperature of 101° Fahr. and the temperature corresponding to the mean boiler pressure was 362° Fahr., each lb. of steam must have taken up 1,123 thermal units; and the equivalent evaporation from and at 212° Fahr., had the whole of the feed-water been turned into steam, would therefore have reached the very high figure of 13·06 lbs. of water per lb. of coal. The equivalent amount of heat utilised per lb. of coal would be 12,610 thermal units, or say 84·3 per cent. of the whole calorific value of the fuel. Such a figure, although unusually high, is of course not in the nature of things impossible; but if it really represented the evaporation in this case, it would follow (as will be seen from the figures below) that the unusual economy of the boilers was accompanied by an unusual want of economy in the engines. Fortunately the measurements made were sufficiently complete to enable it to be stated positively that (from whatever cause) the whole of the water pumped into the boiler was *not* turned into steam. The observations on which this statement is based are summarised in the next paragraph.

The very complete and uniform series of samples of chimney gases, of which the analyses have been given in Table 4, enable the calculations connected with them to be made with considerable exactness and certainty. The weight of dry air per lb. of coal calculated from these analyses works out to 31·6 lbs., so that the total weight of furnace gases per lb. of coal would be about 32·6 lbs. The gases have been raised in temperature from the temperature of the outer air, say about 55° Fahr., to 477° Fahr., the chimney temperature. Taking the mean specific heat of the gases as 0·238, this corresponds to a loss of 3,307 thermal units per lb. of coal, or 22·1 per cent. of the whole calorific value of the fuel, including the raising through the same range of temperature of the steam formed by the combustion of the hydrogen in the fuel. The loss due to evaporation of the moisture in the fuel is so small as to be negligible, and in no one of the twenty analyses was any carbonic oxide found to be present in the chimney gases. The loss by radiation was no doubt considerably less than in the *Colchester* (the stoke-holds being very much cooler), but taking it as low as 8 per cent. and adding to it the 22 per cent. carried away by the chimney gases, it seems certain that the maximum boiler efficiency which can have been reached cannot have exceeded 70 per cent. This would correspond to an evaporation of 10·8 lbs. of water from and at 212° Fahr. per lb. of coal, which is about 83 per cent. of the apparent evaporation mentioned above. It is moreover to be noted that on the original log sheets the reporter finds in five different places memoranda made at different times by different assistants who were taking indicator diagrams, that they were unusually troubled by the amount of water which came through the indicator cocks.

Coal Consumption.—The total coal burnt, namely 1,920 lbs. per hour, corresponds to 1·77 lbs. per I.H.P. per hour. This is equivalent to 1·82 lbs. of carbon-value per I.H.P. per hour.

Engine Efficiencies.—Although the total quantity of water pumped into the boilers per I.H.P. per hour amounted to $\frac{21{,}564}{1{,}087\cdot4}$ or at the rate of 19·83 lbs. per I.H.P. per hour, the quantity of *steam* consumed could not have exceeded, as the figures in the preceding paragraph show, 16·5 lbs. per I.H.P. per hour. The difference must be attributed to priming.

Total Efficiency.—The combined efficiency of the boiler and engines, or ratio of the heat turned into work to the total heat of combustion, was 9·7 per cent.

Steam from Indicator Diagrams.—The following are the results of measurements made upon all the indicator diagrams taken, to ascertain the proportion of steam accounted for by them. The actual weight of feed-water used per revolution was 51·3 lbs.

Proportion of Steam accounted for by indicator diagrams.	Lbs. per Revolution.	Percentage of Total Feed.	Percentage in Jackets or present in cylinder as water.
	Lbs.	Per cent.	Per cent.
Steam present in high-pressure cylinder after cut-off, when the pressure was 115·4 lbs. per square inch above the atmosphere -	2·32	45·2	54 8
Steam present in intermediate cylinder, when the pressure was 33·4 lbs. per square inch above the atmosphere - - -	2·53	49·2	50·8
Steam present in intermediate cylinder when the pressure was 9·4 lbs. per square inch above the atmosphere - - -	3·03	59 0	41·0
Steam present in low-pressure cylinder near end of expansion, when the pressure was 7·1 lbs. per square inch below the atmosphere	3 12	60·7	39·3

Speed of Vessel.—The following notes from the log-book of the ship may be of interest:—

	Time.
Left London Docks	5.0 a m.
Gravesend	7.20
Nore	8.35
Girdler Lightship	9.30
Dover	12.40 p m.
Dungeness	2 20
Royal S. Light-vessel	4 20
Beachy Head	5.0
Owers	8.0
St. Catherine	11.30
Portland	5.0 a m.

* The Research Committee on Marine Engine Trials, in presenting to the members of the Institution their second report upon their work, desire it to be quite understood that they do not at all look upon their duties as yet ended. They are glad to be able to think however that they have already done enough to show that engine trials can be conducted on board ship on as complete a scale and in as scientific a method as on land (although perhaps with greater difficulty and discomfort to the observers), and that this can be done without any undue interference with the normal working of the ship or engines.

The Committee wish also to say that they hope, when their work is completed, to present to the members a comparative summary of all their experiments, in the discussion on which many points as to the influence of design on economy may be better discussed than at present. Their future work may be much helped however by suggestions made at this stage as to improvements in the methods or in the instruments used, or as to the best means of ensuring the accuracy, or measuring the errors, of gauges, indicators, &c. They would also point out that there still does not exist any satisfactory means for measuring the *effective* H.P. of a marine engine in its actual work, *i e.* the power actually expended in pushing the ship forward (as measured by the thrust of a propeller and the speed of the ship), nor for measuring the quantity of the condensing water, a knowledge of which is necessary to enable a "heat balance" for the engines to be made.

There is added to this report a table showing the comparative results obtained in the four trials as yet made by the Committee, and also two appendices, the first giving the instructions for taking indicator diagrams now adopted, and the second giving a list of the members of this Institution and others who have taken part in the trials.

Appendix I.

Instructions given for taking Indicator Diagrams.

See that indicators have proper length of stroke, and are not on stops.
Blow through before taking every card.
Mark number of card in top right-hand corner.
Let H.P. top cards begin with No. 1, H.P. bottom with 101, I.P. top with 201, I.P. bottom with 301, L.P. top with 401, and L.P. bottom with 501.
Let top and bottom cards of each cylinder be taken as nearly as possible together, and the whole set as quickly as possible.
After having taken a set of cards and entered time in log, &c., put on the new papers at once for the next set.
Draw atmospheric line by hand with full stroke.
First watch to get indicators ready before starting and note numbers of indicators and marks and scales of springs on log sheet.
Second watch to verify these numbers and after taking last cards on the watch interchange top and bottom indicators of each cylinder.
Third watch to verify the changed numbers.
Fourth watch, after taking last set of cards, to take off indicators and put them in boxes.
Examine every set of cards before putting away, to detect anomalies and errors. Compare top and bottom cards of each cylinder for length, pressure and general appearance. If any difference is noticed, or anything suspicious about cards, report at once to engineer in charge of watch.
Keep the indicator boxes shut, and the papers in them.

Appendix II.

Staffs of Observers.

Members of the Institution are marked with an asterisk.

In the *Fusi Yama* trial one watch was taken by Mr. R. H. Willis, with Messrs. L. A. Legros* and J. R. Sharman; and the other by Professor Kennedy,* with Messrs. P. G. Evans and A. P. Head.* Mr. Frederick Edwards,* as superintendent engineer for the owners, took general charge of the working of the engines throughout.

In the *Colchester* trial Mr. Frederick Edwards* took one watch, with Messrs. A. G. Ashcroft, R. H. Willis, P. G. Evans, J. R. Sharman, L. S. Robinson, W. E. Burgess, A. P. Head* and J. T. Ewen; while Professor Kennedy* took the other watch, with Mr. E. L. Morris,* Professor T. H. Beare, and Messrs. H. R. J. Burstall, E. C. de Segundo, L. A. Legros,* D. White and W. A. Cloud. Mr. C. J. Wilson collected the gas samples personally during the whole of the trial.

In the *Tartar* experiments Mr. Frederick Edwards* took one watch, with Messrs. A G. Ashcroft, C. L. Simpson,* L. A Legros.* J. R. Sharman, A. P. Head,* H. Cochrane and J. T. Ewen; and Professor Kennedy* took the other watch, with Messrs. R. H. Willis, R. Rogers, D. Capper, E. C. de Segundo, P. G. Evans, W. E. Burgess and W. A. Cloud. Mr. Wilson again personally collected the whole series of gas samples, and Mr. Bryan Donkin, Jun.,* attended to other duties on deck.

The Captains and Chief Engineers of the three vessels, Captain J. Caine and Mr. W. Towers of the *Fusi Yama*, Captain Nickerson and Mr. I. Cartlidge of the *Colchester*, and Captain D. S. Bailey and Mr. W. Brown of the *Tartar* gave every assistance to the staff in carrying out their observations, and by their valuable co-operation contributed materially to the success of the trials.

THE DISTRIBUTION OF EVAPORATION IN A MARINE BOILER.[*]

By C. E. Stromeyer, Esq., Member.

THIS subject has not been dealt with at previous meetings of this society, but I have been able to avail myself of some very interesting enquiries by Mr. D. K. Clark[†] and Mr. J. A. Longridge[‡] into the distribution of evaporation of locomotive boilers. Naturally their chief interest centres on the question of the distribution over the length of the tubes, the diameters of these boilers being very much less than their lengths. In a marine boiler the case is almost reversed, and it often happens that we have combustion chambers high enough to stand in, while the tubes hardly exceed 6 ft. in length, and it is very probable that there must be more gas (or products of combustion) passing through the upper than through the lower tubes.

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[*] Read at the Thirty-first Session of the Institution of Naval Architects.

[†] Institute of Civil Engineers, vol. xlvi. page 242.

[‡] *Ibid.*, vol. lii. page 101.

This distribution is governed partly by the temperatures in the combustion chamber and smoke-box, and partly by the resistance of the gas in the tubes, and this again depends upon the velocity and temperature of the gas, and on the loss of heat experienced by it. It will therefore be necessary to deal first with some of these problems.

The co-efficient of transmission of heat through boiler tubes or combustion chamber plates found by Mr. Longridge is eleven cals. of heat per square foot per hour for every degree (Fahr.) of difference between the gas and the water: 0·91 is the reciprocal value of the above, and is the resistance offered to the flow of heat under the above condition. Now this resistance is composed of the resistance which is offered when heat passes from one medium to another, as, for instance, from the gas to the metal, from the metal to the boiler scale, or to the water, and it also includes the resistance offered by the metal and the scale. For iron, and for plaster of Paris, which latter is the same substance as boiler scale, the resistances are 0·00202 and 0·207 per inch thickness, so that a clean half-inch plate would offer 0·001 resistance, or, if covered with scale 1-10 thick, the resistance would be 0·001 + 0·021 = 0·022.

Comparing these values with 0·091, which is the value adopted by Mr. Longridge, we are driven to the conclusion that the chief resistance, about 80 per cent., is encountered at the surfaces. I doubt whether the change of medium from iron to scale, and to water, influences the above values very much, as it seems more than probable that the chief difficulty in transmitting heat from the gas to the tubes is the want of circulation, and the outer layers of the gas are not replaced sufficiently quickly by the inner ones, which are hotter. It ought to be possible to effect this by draught retarders, or by using corrugated boiler tubes; and I also believe that the excellent results which have been obtained by the use of John Brown's ribbed tubes is simply due to the increased inner surface which is exposed to the gases, whereby the resistance is diminished from 0·091 to 0·055.

If the above is the true explanation, then I believe that Mr. Longridge is not quite correct in adopting the same co-efficient for the combustion chamber as for the tubes, because, in the former case, heat is imparted to the plates, not only by contact, but also by radiation, and, under these circumstances, a recalculation of his results would most likely lead to a higher value for the resistance of the tubes, and a lower one for the combustion chambers.

That radiation plays an important part will be seen from the experiments by M. P. Havrez,* referred to by Mr. Clark. In one of his experiments coke was used, while in the other one briquettes were burnt, and it was found that there was relatively more heat absorbed in the firebox with the flaming material than with the flameless coke, and it is well known that a luminous flame radiates more heat than a non-luminous one, for which reason the latter may not be used in the Siemens-Martin furnace.

For these various reasons, I believe that the formulæ used by Mr. Longridge for the heating of boiler tubes will be more correct if the co-efficient of resistance $\frac{1}{m}$ is increased a little, say from 0·091 to 0·1, so that his formulæ would be—

$$t = t_0 \cdot \epsilon^{-\frac{10 \cdot S}{h}}$$

$$H = h\,t\left(1 - \epsilon^{-\frac{10 \cdot S}{h}}\right)$$

t = Difference between the temperatures of the boiler water and of the gas in the tube after having traversed S square feet of surface.

t_0 = Difference of the above temperatures before the gas has entered the tube.

ϵ = 2·718 . . .

$h = \sigma \cdot Q$ = Specific heat × Weight of gas (products of combustion) passing through the tube.

H = Quantity of heat transmitted through the walls of the tubes. This quantity divided by 1,150 gives the quantity of water evaporated from 60° F.

The co-efficient 10 is the quantity of heat transmitted per hour, therefore the time units of h and H must also be the hour.

I intend to adopt the following values:—

$\sigma = 0·236.$

$S = \pi \cdot D \cdot L \cdot = \pi \cdot 3 \text{ in.} \cdot 6 \text{ ft.} = 4·72$ square ft.

Instead of Q, the weight of the products of combustion, I intend to use C = the weight of coal from which Q has been produced.

$$Q = 30 \cdot C \text{ nearly.}$$

Then $$t = t_0\,\epsilon^{-\frac{20}{3 \cdot C}}$$

$$H = 7·08 \cdot C\,t_0\left(1 - \epsilon^{-\frac{20}{3 \cdot C}}\right)$$

These formulæ have been arrived at without taking into account the fact that the gases grow denser and travel slower as they grow colder, and that they therefore remain longer in contact with the tube surfaces. Fortunately, the influence of the reduction of speed and increased density balance each other, and no correction need be added to the above.

Before leaving the subject of conductivity, it will be as well to mention the case of tubes which are partly choked with ashes. One would suppose that their efficiency is reduced in the same ratio as the exposed surface, but this is not quite the case, especially if they are coated with scale and if the differences of temperature are not too great. Then the heat travels down the sides of the tubes, and the exposed inner surfaces being colder than those of tubes without obstruction would also absorb more heat per square foot of exposed surface. The numerical values can be obtained by determining the values of the various constants in the following formulæ.

$$t_1 = A + B \sin \alpha \cdot x$$

$$t_2 = a\left(\epsilon^{\beta x} + \epsilon^{-\beta x}\right)$$

Here t_1 is the temperature of the top part of the tube, and t_2 that of the bottom part; x is measured on the circumference of the tube, starting from the top or bottom. All the other values are constants, which can be determined; t_1 and t_2, as well as their first differential quotients, must be equal at the boundary formed by the ashes.

As there exist very large differences of temperature in a boiler, it is desirable, while dealing with the flow of the gases, to take them into account, and it will therefore be necessary to construct the formulæ for the resistance of gas in motion.

Starting from the well-known formulæ

$$v^2 = 2\,g\,h$$

where v is velocity of acceleration due to gravity, and h the height of the fall or the height of the liquid, it can be replaced by $\frac{p_1}{S}$ which is the pressure per square foot divided by the weight of one cubic foot of gas. S the denominator is inversely proportionate to its absolute temperature T_1 and we have

$$v^2 = 2\,g\,\frac{p_1}{S_0}\,\frac{T_1}{T_0}$$

S_0 = 0·0845 lbs per cubic ft. at 32° F. or at T_0 = 493° absolute temperature.

Let a be the sectional area of one tube, then the weight which passes through it per hour is

$$Q = \zeta\,v \cdot a \cdot S \cdot 3600 = \zeta\,a \cdot 3600\sqrt{2\,g\,p_1\,S_0\,\frac{T_0}{T_1}}$$

Here the co-efficient ζ is a co-efficient of experience. Seeing that the resistance to entering the tube is inversely proportionate to the absolute temperature, it is more than probable that the surface friction in the tube is also dependent on it.

$$p = p_1 + p_2 = \frac{Q^2\left(\frac{9}{4}\,T_1 + 0·012\,\frac{S}{a}\,T_2\right)}{(3600)^2\,a^2\,2 \cdot g\,S_0\,T_0}$$

Here S is the surface of the tube, T_2 is the average temperature of the gas in the tube, and 0·012 is a co-efficient of friction adopted by Rankine. Let T be the absolute temperature of the water in the boiler, then the final temperature is

$$T + t = T + t_0\,\epsilon^{-10\frac{S}{h}}$$

and the average temperature is

$$T_2 = T + t_0\,\frac{h}{10\,S}\left(1 - \epsilon^{-\frac{10\,S}{h}}\right)$$

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* Ann. du Génie Civil, 1874.

Inserting the previously found notation, and replacing $\frac{Q}{30}$ by C, we have

$$T_2 = T + t_0 \frac{20}{3\,C}\left(1 - \epsilon^{\frac{20}{3c}}\right)$$

None of these values are negligible, for C can easily be made to exceed unity. The pressure p can then be expressed by a formula of the following form—

$$p = C^2 (a\,T + b\,t_0) + C\,c\,.\,t_0\left(1 - \epsilon^{\frac{20}{3\,c}}\right)$$

Here a b c are constants, and it will be seen that the resistance encountered by a gas which passes through a boiler tube depends not only on the absolute temperature in the combustion chamber $(T + t_0)$ but also on C^2 and C^2.

As matters would get too complicated if the formulæ were carried further, I shall insert the following numerical values, which would, of course, have to be altered for different cases:—

Let the temperature of the boiler water be 379° Fahr. Then $T = 379° + 461° = 840°$. Let the absolute temperature in the combustion chamber be 2840°; then $t_0 = 2000°$, and if the boiler tubes are 3 in. diameter and 6 ft. long, we have $a = 7{\cdot}07$ sq. in. $= 0{\cdot}049$ sq. ft. S, the tube surface, $= 4{\cdot}71$ sq. ft.

$$p = C^2\,0{\cdot}173 + C\,.\,0{\cdot}166\left(1 - 2{\cdot}718\,.\,.\,.^{-\frac{20}{3.C}}\right)$$

$$\log 2{\cdot}718\,.\,.\,.^{-\frac{20}{3.C}} = \frac{1{\cdot}815\,.\,.\,.}{C}$$

$$\log t = 3{\cdot}301 - \frac{1{\cdot}815\,.\,.\,.}{C}$$

All that is now necessary is to determine the value of p, which is the difference of pressure at either end of a tube.

Let P be the value of p for the lowest row of tubes in a combustion chamber; then for any row of tubes situated n feet higher we have $p = P + n\,\Delta p$. Here Δp is the difference of weight of 1 cubic foot of gas in the combustion chamber and in the smoke-box. The temperature of the first of these is assumed to be 2840° absolute, and the latter can safely be taken as the mean value of all the tubes, it is $840 + t$. Now, as the weight of 1 cubic foot of gas at 32° Fahr. is 0·0845 lbs., we have

$$\Delta p = \left(\frac{493}{840 + t} - \frac{493}{2840}\right)0{\cdot}0845$$

Suppose now that the combustion chamber with which we are dealing consists of 10 rows of 10 tubes pitched 4 in. apart: then $n = 2\frac{1}{2}$ ft., and $C_1 = 100\,C$ is the total weight of coal burnt per hour for supplying these 100 tubes, then, assuming C_1 to be 100, 200, 400, and 800 lbs. per hour, corresponding to easy firing, ordinary firing, and strong firing with natural draught, and, lastly, strong forced draught:—

C_1 Consumption per hour.	$379° + t$ Temperature in smoke-box	p Average resistance in tubes.	$\frac{\Delta p}{\Delta C_1}$	Δp Difference of weights of gas.
Lbs.	Deg. Fahr.	Lbs. per sq. ft.		Lbs. per foot
100	382	0·3390	0·0049	0·035
200	626	0·983	0 0079	0·024
400	1,094	3·20	0·0150	0·012
800	1,564	11·60	0·0170	0·006

In order to find the relative quantities of gas which pass through the top and bottom rows of tubes, multiply the values in the fifth column by 1¼ ft., being half the height of the combustion chamber, and divide by the values in the fourth column, and add and subtract from the values of C_1, and divide the one by the other, thus:—

$$100 \pm \frac{1{\cdot}25 \times 0{\cdot}035}{0{\cdot}0049} = 100 \pm 9 = 109 \text{ and } 91,$$

Showing that the top rows receive $\frac{109}{91}$ or 20 per cent. more than the bottom rows, when the average consumption is 100 lbs. per hour. In the other three cases this value is 4 per cent., ½ per cent., and ⅛ per cent.

The difference of the temperature in the smoke-box for each extra pound of coal burnt is 0·2° when the consumption is only 100 lbs., therefore with 20 lbs. difference the range of the temperature of the waste gases is only about 4°. In the three other cases the difference for each extra pound of coal is 0·3°, 0·6°, and 1·0°, and the difference of the final temperatures from the lowest and highest tubes are 2·4°, 1·2°, and 1°, showing that generally the heat is pretty evenly distributed amongst the tubes. I have taken no account of the actual efficiency of the boiler surface, but have restricted myself simply to the theoretical question of the distribution, and by applying the above results to those trials of marine boilers which I am glad to see are now often carried out, it will be possible to obtain accurate values as to the various heating surfaces.

THE SPONTANEOUS IGNITION OF COAL CARGOES.*

By Professor VIVIAN B. LEWES, Associate, F.C.S., F.I.C.

FIFTEEN years ago the loss of life and property caused by the spontaneous ignition of coal cargoes became so serious that the Board of Trade, acting in unison with the Committee of Lloyd's, urged upon the Government the necessity for appointing a Royal Commission to inquire into and report upon the possibility of preventing a class of disaster as appalling in nature as it is destructive in result. The Commission, which was appointed in April, 1875, had the good fortune to be aided in their inquiry by the scientific knowledge of Dr. Percy and Mr. (now Sir Frederick) Abel, and after collecting and collating all the evidence which could be obtained, they in the following year published their report upon the subject. In this report much valuable evidence is passed in review, and much sound advice is given for the guidance of those employed in the shipment of coals; but whether it is that the sight of a blue book scares the ordinary reader, or that the circulation of such literature, often of the most valuable character, is of necessity very limited, the fact remains that the conditions at present existing are as bad as they were before the publication of the report, and the losses of colliers have steadily increased with the growth of the traffic.

In the nine years immediately following the report, viz., 1875 to 1883, 57 coal-laden vessels are known to have been lost from spontaneous ignition of their cargoes, whilst during the same period 328 were missing from unknown causes, a large percentage of these losses being undoubtedly due to the same cause; and these, again, form but a very small percentage of the cases in which cargoes have heated and fired, but in which the vessel has been saved; and now, within the last few years, the statement has gained ground that with the general increase of temperature in steamships, due to the introduction of triple-expansion engines and high-pressure boilers, spontaneous firing in the coal bunkers and coal cargoes, is very much increased, and that many accidents arise from this cause.

Under these circumstances, Mr. Martell suggested to me some time ago that an inquiry into the causes and possible prevention of this very serious evil would be work, not only likely to be acceptable to the members of this Institute, but also one that was needed in the service, as well as in the mercantile marine; and I have now much pleasure in bringing before you the results obtained in a long series of experiments, and which, taken in conjunction with the work done by others on the subject, throws a somewhat clearer light upon the causes of this particular class of phenomenon, and enables suggestions to be made for its prevention.

Coal is a substance of purely vegetable origin, formed out of contact with air by long exposure to heat and pressure from the woody fibre and resinous constituents of a monster vegetation which flourished long before the earth was inhabited by man; and coal may therefore be looked upon as a form of charcoal, which having been formed at a temperature lower than that of the charcoal burner's heap and under great pressure, is very dense, and still retains a quantity of those constituents which, in the latter case, are driven off as tar, wood, naphtha, &c.; and these bodies consist essentially of compounds containing carbon and hydrogen, together with a little oxygen and nitrogen, and form the volatile matter and hydro-carbons of the coal.

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* Read at the thirty-first session of the Institution of Naval Architects, March 28th, 1890; the Right Hon. the Earl of Ravensworth in the chair.

Besides the carbon and hydro-carbons, coal also contains certain mineral bodies, which were mostly present in the sap and fibre of the original vegetation, and which give the ash which is left behind when the coal is burnt.

These substances consist chiefly of sulphate of lime or gypsum, silica and alumina, whilst in nearly all kinds of coal is to be found a substance called disulphide of iron, coal brasses or pyrites, which has been formed by the gradual reduction of the sulphates by carbonaceous matter in the presence of iron salts, and which, during the combustion of the coal, is decomposed, giving off sulphur compounds and leaving behind oxide of iron, which gives the reddish brown colour to the ash left by many kinds of coal.

Of these constituents of coal, the only ones which play no part in the phenomena attending heating and spontaneous ignition are the mineral constituents other than the pyrites, and we have therefore to deal with the chemical actions which take place when the carbon, hydro-carbons and brasses contained in newly-won coal come in contact with air and moisture.

(a) The Influence of Carbon in Producing Heating.

Carbon is one of those substances which possess to an extraordinary degree the power of attracting and condensing gases upon their surface, this power varying with the state of division and density of the particular form of carbon used. The charcoal obtained from dense forms of wood, such as box, exhibit this property to a high degree, one cubic inch of such charcoal absorbing—[*]

Ammonia gas	90 cubic ins.
Sulphuretted hydrogen	55 ,,
Carbon dioxide	35 ,,
Ethylene (olefiant gas)	35 ,,
Oxygen	9·25 ,,
Nitrogen	6·5 ,,

whilst certain kinds of coal also exhibit the same power, although to a less degree.

The absorptive power of newly-won coal due to this surface attraction varies, but the least absorbent will take up 1¼ times it own volume of oxygen, whilst in some coals more than three times their volume of the gas is absorbed. This absorption is very rapid at first, but gradually decreases, and is moreover influenced very much by temperature, for reasons which will be explained later.

The absorption is at first purely mechanical, and itself causes a rise of temperature, which, in the case of charcoal formed in closed retorts, as in preparing alder, willow, and logwood charcoal for powder-making, would produce spontaneous ignition if it were not placed in sealed cooling vessels for some days before exposure to air.

The rate of absorption varies with the amount of surface exposed, and therefore able to take part in this condensing action, so that when coal or charcoal is finely powdered, the exposed surface being much greater, absorption becomes more rapid, and rise of temperature at once takes place. If charcoal is kept for a day after it has been made, out of contact with air, and is then ground down into a powder, it will frequently fire after exposure to the air for thirty-eight hours; whilst a heap of charcoal powder, of 100 bushels or more, will always ignite. It is for this reason that, in making the charcoal for powder, it is always kept, after burning, for three or four days in air-tight cylinders before picking over, and ten days to a fortnight before it is ground.

In the case of coal, this rise in temperature all tends to increase the rate of the action which is going on; but it is rarely sufficient to bring about spontaneous ignition, as only about one-third the amount of oxygen being absorbed by coal that is taken up by charcoal, and the action being much slower, tends to prevent the temperature reaching the high ignition point of the coal. Air-dry coal absorbs oxygen more quickly than wet coal.

(b) The Action of the Bituminous Constituents of the Coal in Spontaneous Ignition.

All coal contains a certain percentage of hydrogen, which is in combination with some of the carbon, and also with the nitrogen and oxygen, and forms with them the volatile matter in the coal, and the amount present in this condition varies very largely, being very small in anthracite and very great in cannel and shale. When the carbon of the coal absorbs oxygen, the compressed gas becomes very chemically active, and very soon commences to combine with the carbon and hydrogen of the bituminous portions, converting them into carbon, dioxide, and water vapour. This chemical activity increases rapidly with rise of temperature, so that the heat generated by the absorption of the oxygen causes it to rapidly enter into chemical combination. Chemical combination of this kind—*i.e.*, oxidation—is always accompanied by evolution of heat, and this further rise of temperature again increases rapidity of oxidation, so that a steady rise of temperature is set up, and this taking place in the centre of a heap of small coal, which, from the air and other gases enclosed in its interstices, is an admirable non-conductor of heat, will often cause such heating of the mass that if air can percolate slowly into the heap in sufficient quantity to supply the necessary percentage of oxygen for the continuance of the action, the igniting point of the coal would be soon reached.

The effect of rise of temperature in increasing the rapidity of chemical actions of this kind can be realised from the effect which it has in the spontaneous ignition of oily waste or rag.

If a substance like cotton waste be rendered oily with anything except the mineral oils, it acquires the power of taking up oxygen from the air, and this oxidising the oil gives rise to heat. At ordinary temperatures this oxidation is slow, and, consequently, it may be days before the rise in temperature becomes sensible, but when this point is reached, the oxidation proceeds with remarkable rapidity, and in a few hours the point of ignition is reached, and the mass bursts into flame, whilst, if the oily waste be placed in a warm place at first, spontaneous ignition is only a question of hours or sometimes even minutes.

Galletley found that oily cotton at ordinary temperatures took some days to heat and ignite, whilst placed in a chamber warmed to 130° to 170° F. (54° to 76° C.), the cotton greasy with boiled linseed ignited in one hour fifteen minutes, and olive oil on cotton in five hours, and in a chamber heated to 180° to 200° F. (82° to 93° C.) olive oil on cotton ignited in two hours.

It has been suggested that very bituminous coal, such as cannel, shale, and coals containing schist, is liable to spontaneous ignition from the fact that a rise in temperature would cause heavy oils to exude from them, which, by undergoing oxidation, might cause rapid heating. But experiment not only shows this is not the case, but that the heavy mineral oils have a remarkable influence in retarding heating, cotton waste, oily with easily oxidisible oils mixed with 20 per cent. of heavy mineral oil, being exempt from heating.

(c) The Action of Iron Disulphide, Pyrites, or Coal Brasses in Promoting Spontaneous Ignition.

Ever since Berzelius first expressed the opinion that the heat given out by the oxidation of iron disulphide into sulphates of iron might have an important bearing on the heating and ignition of coal, it has been adopted as the popular explanation of that phenomenon; and although the work of Dr. Richters clearly proves this not to be the case, the old explanation is given, a notable exception, however, being in the case of our great metallurgist, Dr. Percy, who, as early as 1864, pointed out that probably oxidation of the coal had also something to do with spontaneous combustion, a prediction amply verified by Dr. Richters' researches some six years later.

This disulphide of iron is found in coal in several different forms, sometimes as a dark powder distributed throughout the mass of the coal, and scarcely to be distinguished from coal itself. In larger quantities it is often found forming thin golden-looking layers in the cleavage of the coal, whilst it sometimes occurs as large masses and veins, often an inch to two inches in thickness, but inasmuch as these masses of pyrites are very heavy, they rarely find their way into the screened coal for shipment, many hundreds of tons of these "brasses" being annually picked out from the coal at the pit's mouth, and utilised in various manufacturing processes. If the air is dry the pyrites undergo but little change at ordinary temperatures; but in moist air they rapidly oxidise when in a finely divided condition, the first action being the formation of ferrous sulphate and sulphur dioxide, together with the liberation of sulphur, the relative amounts of the two latter being regulated by the temperature and the supply of air, whilst longer contact with moist air converts the ferrous sulphate into a basic ferric sulphate generally termed "misy."

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[*] Saussure.

It is during this process of oxidation that the heat supposed to cause the ignition is evolved. But when it is considered that some of the coals most prone to spontaneous combustion contain only eight-tenths of a per cent. of iron pyrites, and rarely more than 1½ per cent., the absurdity of imagining this to be the only cause of ignition becomes manifest. If 100 lbs. of coal were taken, and the whole of the pyrites in it concentrated in one spot and rapidly oxidised to sulphate, the temperature would barely be raised to 100° C., if all loss of heat could be avoided. Besides which, in certain manufactures pure iron pyrites are largely used, and, when free from carbonaceous matter, may be kept in a state approaching to powder in heaps containing many hundred tons; and although undergoing continual oxidation, I have been unable to trace a single case of heating, much less a rise of temperature which would approach the igniting point of coal. When, however, it is mixed with finely divided carbonaceous matter, then heating and ignition is a frequent occurrence in even moderate-sized heaps.

I have carefully determined the igniting point of various kinds of coal, and find that—

Cannel coal	ignites at	698	deg. F.,	equals	370	deg. C.
Hartlepool coal	,,	766	,,	,,	408	,,
Lignite	,,	142	,,	,,	450	,,
Welsh steam coal	,,	870·5	,,	,,	477	,,

So that no stretch of imagination could endow the small trace of pyrites scattered through a large mass of coal, and undergoing slow oxidation, with the power of reaching the needful temperature.

Dr. Richters fully realises this point, and discards the idea of the pyrites doing anything more than adding their mite to the causes which bring about rise of temperature. In this, however, I think he is mistaken, my experiments, which will be published when complete, pointing to the fact that they may increase the liability to ignition when present in large quantities, and do so by liberating sulphur under certain conditions. Now, sulphur has an igniting point of 482 F. or 250 C., so that the presence of free sulphur would lower the ignition point of the coal by considerably over 100 degrees centigrade, the sulphur in this case playing exactly the same part that it does in gunpowder, in which it lowers the point of ignition, and increases the rapidity of combustion. A still more important part played by the pyrites is, that as they become oxidised to ferrous sulphate, they swell in size, and so tend to split up the coal into small pieces, and by exposing a large extent of fresh surface to the air cause increase of temperature and energetic chemical action.

(To be concluded in our next).

Hull Institution of Naval Architects.—On the evening of May 13th the members of this institution held their annual social evening and exhibition in the Gladstone Hall, Mr. Bohn, the president, presiding. There was a very good attendance, and the exhibits equalled, if they did not rise superior to, last year. Among those present were the principal engineers of the town, including Captain Laws, Messrs. Martin Samuelson, A. E. White, R. Murray, W. Wylie, J. Todd, J. Key, sen., C. D. Holmes, G. J. Cole, T. Rose, J. H. Richardson, J. H. Spring, J. Spears, F. H. Street, W. Harris, J. F. Wilkins, R. Barton, W. Gemmell, Pearson, Peasegood, Amos, Pauling, Stirling, Dale, Brentano, Jameson, Jamieson, Humphrey, Bishop, Good, Cook, C. H. Fitzmaurice, Pearson (secretary), and others. Alderman Symons and Mr. Dnesbury (the Postmaster), were also present.—In opening the meeting the Chairman said that last year's meeting was a great success, and he hoped their experience that night would justify them in closing the session in a similar manner. He thought it was desirable that the engineers of the town should be brought together in a social way to give them an opportunity of friendly conversation and exchange of views.—During the evening Mr. Bohn presented the prizes to the successful students. All the papers were most excellent, and considerable difficulty had been experienced in arriving at a decision. The first prize of a bronze medal and £2 2s. had been awarded to Mr. J. Key, jun., and the second, which was £3 3s. divided between Messrs. F. R. Smith, Charles Lloyd, and E. C. Williamson. While it would be impossible to mention all the exhibits, note may be made of Messrs. Amos and Smith's patent contractors' excavator, Messrs. Street's patent Acme ventilators, Messrs. Priestman's oil engine, telegraphic ments from the post-office, and a painting of an old wood t, lent by Alderman Symons.

THE EDINBURGH INTERNATIONAL EXHIBITION.

The backward state of this undertaking, even at the date appointed for its ceremonial opening, the 1st of May, is our excuse for the brief and general nature of the notice we gave in our last issue, which had to be in the press several days before the 1st of the month. We now propose dealing more thoroughly with the subject, touching briefly on those points dealt with in last month's notice, and taking a general survey of the Exhibition as a whole. This proposal is all the more easy of accomplishment now that something like completeness characterises the display. We shall, of course, give the lion's share of attention to matters in which our readers are more particularly interested, but this we propose doing thoroughly in articles descriptive of individual firms' exhibits, to be given in this and subsequent issues, the present article being only general.

Originally intended to be confined to subjects connected with electrical and mechanical engineering, the Exhibition, as now opened, has been extended to all the Arts, Sciences and Industries, and for general interest may compare not unfavourably with the exhibitions hitherto held in Scotland—the Edinburgh Exhibition of 1886, and the Glasgow show of 1888. The present Exhibition, however, although much larger and at least as interesting from an all-round point of view as the last Edinburgh show, is not so noteworthy in the special branches of engineering with which our readers are mostly concerned. Again, it is less so, in all respects, than the Glasgow Exhibition of two years ago. Apart from its reduced size there is not the same comprehensiveness in the classes of exhibits brought together. There is, too, less evidence of an exact and rigid classification having been adhered to; the most that has been done being the placing, as far as possible, of kindred exhibits in the same courts. All this, however, may be very well excused on the grounds of the successive and continued expansion of the original scope of the Exhibition, making it much more difficult, if not altogether impossible, to allow space for the multifarious exhibits under their proper sections. One very general feature, sure to commend itself to visitors desirous of acquainting themselves with engineering subjects, and to others, is the virtual separation of the section embracing electrical and general machinery from the other sections, which largely includes those branches of industry with which art more than science is associated. The machinery hall is a section of the Exhibition virtually detached from the main building, with which it is, however, in touch, by means of a covered way conducting over the North British Suburban line of railway, which here traverses a deep cutting, and divides the Exhibition grounds in two. The total site occupies 50 acres, and it occurs at the junction of the suburban line of railway with that of the main line of the Caledonian Railway between Edinburgh and Glasgow. A special Exhibition station has been erected on each of these lines, within, or in close proximity to, the Exhibition grounds. The Edinburgh Tramway Co.'s Colinton Road line passes in front of the main entrance, and also parallel with it the Edinburgh Union Canal, over which the main entrance is conducted by broad covered flights of steps

Whatever other attractions the Exhibition buildings may possess or contain, they owe but little to architectural grandeur or embellishment. They consist of a low range of wood buildings irregularly grouped, and, if impressive at all, only so on account of their elongated extent. When, however, the modesty of the scheme as first conceived, and the continual growth and expansion which have taken place, are remembered, the executive will not be blamed for confining themselves mainly to the adequate and necessary, and leaving the ornamental to be introduced as a mere incident. Almost the only place where the monotonous outline of the structure has been broken with any effect is the main doorway, but it is just the place where omissions of all architectural embellishment would have been inexcusable. The façade here is composed of two square towers flanking the main doorway, which taper gracefully, and rise to a total height of 130 ft., terminating in Moorish domes and finial posts. Between these towers and over the arched doorway are bannerets and shields bearing the arms of Edinburgh, Glasgow, Aberdeen, Dundee, Greenock, Paisley, and other Scottish towns, and in the centre is a beautifully modelled statue of a female, representing "Electricity." Lower down, and some distance apart, are two figures of youths holding aloft—as in the case of "Electricity" herself—electric torches. On either side of the doorway and centred on the towers are groups of statuary emblematic of scientific and engineering progress.

In more respects than that of plain, unpretentious exterior, evidences are not wanting of the effort which has been made to save outlay, but on the whole the best has been done that was possible towards putting the Exhibition on the fair way to a compensating if not a profitable career. The number of outside and inside features primarily designed to entertain visitors is legion, and for this as well as other revenue-yielding features, the promoters have to thank the enterprise and experience of Mr. S. Lee Bapty, already well-known in connection with the piloting of great international displays.

As indicated in last month's issue, the site extends altogether to about fifty acres, the main buildings and annexes (but exclusive of the cafés, kiosks, and other outside erections) extending altogether to about 370,000 square feet. The main building to the east of the Suburban Railway is, generally speaking, devoted to British and Foreign miscellaneous exhibits, but also embraces large concert hall, art and sculpture galleries, &c. In round figures it measures 700 ft. long by 300 ft. broad, the concert hall and entrance vestibule, which conducts to it, in themselves occupying as much as 300 ft. by 100 ft. The machinery and electrical hall to the west of the railway measures 700 ft. by 150 ft. wide, in addition to which are the boiler-house and locomotive annexes, the latter of which is 300 ft. long by 70 ft. in width. The buildings have been designed by Mr. W. Allan Carter, M.Inst.C.E., Edinburgh, assisted by Mr. Frank Simon, architect, and Mr. Penman, Assoc.M.Inst.C.E. Wood has been almost exclusively employed in the construction of the buildings, and in this way, while securing economy, effectiveness and gracefulness—at least internally—have been also attained. Originally it was intended to use iron in various parts of the structure, —*e.g.* standards, roof principals, &c.—but owing to the high price holding in the iron market, it was afterwards resolved to utilize wood in every way possible. So much so has this been done that substantiality and economy have been remarkably blended. The matter of disposing of the timber after the buildings have served their purpose has also been considered and allowed for. Except when quite unavoidable "marketable" sizes have not been broken and standards, principals, trusses, &c., all throughout have been constructed of deals,—double, treble, or quadruple ply—to make up the requisite scantling. The foundations of the main walls are of brick and solid blocks of stone under the standards. The roofing is of galvanized corrugated sheet iron, with glazing and louvre ventilators all along the ridges.

Having spoken of the buildings and site it will now be fitting that attention should be turned to the varied contents of the Exhibition. While the illustration of the progress and development in electrical science, invention, and industries, was nominally and originally the *raison d'être* of the undertaking, the promoters and their able general manager have so extended the scope of the Exhibition, as to make it embrace almost the entire circle of the applied sciences, manufactures, and natural products. The whole scope of the Exhibition, as defined in the prospectus, is comprised in two general divisions: Division I. dealing with "Electrical Engineering and Inventions," and Division II. with "General Inventions and Industries." The first division is divided into six sections, as follows: Production of electricity, electrical conductors; measurements; applications of electricity; works relating to electricity; plans, drawings, &c.; historical collection. The second division is divided into as many as sixteen sections, these respectively being:—Mining and metallurgy; gold-mining and the production of precious metals and stones; rural industries; architecture; hygiene; decorative art, furniture and accessories; music; clothing and accessories; food and drinks; education and the liberal arts; engineering and machinery; navigation; chemical and allied industries; other manufactures and raw material; women's industries; artisans' industries. A supplementary division deals with fine arts, and the total number of classes in the various divisions is 120.

On the visitor's right hand, as he enters the Exhibition building by its main entrance, are the courts allotted to the exhibits shown by Foreign countries. Beyond saying that these are almost wholly made up of art glassware, porcelain, statuary, &c., which of course indicates the high degree of skill to which Continental nations have attained in art industries, it would be idle, in view of what must be of most interest to our readers, to treat of these sections at greater length.

Commencing at the west of the concert hall, the British section covers a large superficial area, runs in a due westerly direction, then turning to the north and traversing the statuary section, with the fine-art courts leading off to right and left, the covered way is reached, which conducts, again in a westerly direction, to the machinery and electrical hall. The exhibits throughout these courts also are, as a rule, of the type usually associated with bazaar goods, although being British, they partake more of the solid and utilitarian character than those of the Continental and Oriental sections of the Exhibition. Furniture and accessories, music, clothing and accessories, foods and drinks, chemical and allied industries, hygiene, decorative arts, &c., &c., are here all represented—not always in the most intelligible grouping—and doubtless for general visitors must afford a good means of contrasting British with Foreign skill. Our readers, however, will not thank us for more extended allusion to matters so far out of our domain, so we at once single out what is of interest within the limits.

To the shipbuilding industry has been assigned the most westerly of the courts in the main buildings. While it compares very unfavourably in point of extent and variety with the display made at Glasgow two years ago, or even at Edinburgh in 1886, there is still much of an interesting nature in this section. The Clyde naturally takes the lead in the matter of a display of models, but even the premier river is but inadequately represented in this respect. Leith, Grangemouth, and other shipbuilding ports on the east coast of Scotland, strange to say, are wholly unrepresented. Some compensating circumstances, however, may be found in the fact that the few exhibits are all of the first interest. Most of the models from the Clyde represent dredgers, hopper-barges, and other specialized work for which it has now so widespread a name and fame. Messrs. Simons & Co., of Renfrew, Messrs. Fleming & Ferguson, of Paisley, and Messrs. Lobnitz & Co., Renfrew, have each most tastefully arranged stands, on which they exhibit beautifully complete and well made models of a selection of their latest productions. Messrs. Simons show a model of a hopper dredger constructed for Belfast, and fitted with their patent traversing bucket ladder to enable dredger to cut its own flotation through shoals and banks. Hopper dredgers of this type, our readers may be reminded, combine in one bottom, and with one crew, all the properties of the fixed dredgers and attendant barges formerly in vogue. In the case of the hopper-dredger, of which this model is a counterfeit presentment, capability is evidenced by a capacity to carry fully 850 tons, and raise 600 tons per hour. Another model represents one of the firm's patent elevating ferry steamers such as has just been launched for the Clyde Trust for service across the Clyde at Finieston. This vessel, which we hope to illustrate and fully describe in a future issue, carries a movable deck or platform for the carriage of vehicles and passengers, capable of being raised or lowered to the level of the quay walls at any state of the tide. Other noteworthy models are shown on Messrs. Simons' stand, but as we purpose returning specially to the subject of Naval Architecture in a future article, what has been said must meantime suffice. Messrs. Fleming & Ferguson's exhibits comprise models of hopper dredgers and yachts, and they also show photos of yachts, dredgers, and their highly successful patent balanced quadruple engines, having four cylinders on one plane, and with two cranks directly opposite each other. More shall be said of this firm's exhibits also in the article referred to. Messrs. Lobnitz & Co. have a large variety of models, selected evidently not only with the view of showing what their modern productions are like, but in order to illustrate the progress which has been made in the several branches of marine architecture and engineering, with which this firm has long been connected. The Royal Mail Steam Packet Co., London, show a superbly finished model of their s.s. *Orinoco*, 4,478, built lately by Messrs. Caird & Co., of Greenock. They also show a working diagramatic model of the engines of the steamer, by means of which the motion of the parts is made intelligible to even the most uninitiated. To Messrs. Denny & Co., Engineers, Dumbarton, the Exhibition owes one of its most interesting exhibits. This consists of a splendidly finished working model, on a scale of ½ in. per foot of the engines, on Brock's principle, as fitted into the *Princess Henriette* and *Princess Josephine*, the remarkably successful Channel paddle steamers belonging to the Belgian Government and employed in the mail service between Ostend and Dover. These vessels on trial attained a speed of 21½ knots per hour. We hope to illustrate and describe the engines in a future issue. Messrs. Napier, Shanks & Bell, of Yoker, contribute a pair of cases containing fine models of vessels recently produced by them. One is the twin-screw steamer *Islander*, built for the Canadian Pacific Navigation Co., of Victoria, British Columbia, and the other the paddle steamer *Hygeia*, built for Messrs. Huddart, Parker & Co., Melbourne, and presently being completed at Greenock, where Messrs. Rankin & Blackmore are equipping her with a set of their patent engines. Both these vessels are a credit to their builders and engineers. Only one firm from Tyne—Messrs. Swan & Hunter, of Newcastle—submit samples of their productions. These comprise models of a Channel paddle steamer 320 ft. long, and two screw steamers, the largest of which is designed for both passenger and cargo carrying. Messrs. Donald Currie & Co. show a model of the *Norham Castle*, one of the crack boats of their Castle Packet Line to the Cape, while their competitors in the same service—the Union Steamship Co.—are in evidence with half models of their steamers *African* and *Tartar*. Life-buoys, life-belts, and life-saving apparatus of all kinds and dimensions, form the tastefully arranged exhibit of Messrs. Steedman & M'Alister, of Glasgow, to which fuller reference will be made in a future issue. Dr. P. Murray Braidwood, of Minto House, Shirehampton, West Bristol, exhibits in frame, sections and plans of hospital ships; and an improved life-buoy is shown by Alexander Smith, of Arbroath.

In addition to the electric generating plant employed in lighting the buildings, it will, of course, be understood that in an exhibition originally intended to be primarily, if not wholly, representative of this branch of science and industry, there should be hundreds of other electrical exhibits within the machinery section. This is in reality the case, and in the half of the machinery hall to the east of the dynamo court are to be found multifarious examples of the productions of electrical manufacturers, many of them new and eminently noteworthy. Not a few of these are combination engines and dynamos designed for ship lighting; others are new electro-motors—a branch in the development of electrical science for which, in our opinion, there is the greatest possible future in connection with steamship deck appliances, as well as in mills and factories on land. We need not here enumerate the various firms exhibiting such items, as in future issues attention will be devoted to this important branch of science and industry.

The west end of the machinery hall is devoted to general engineering and miscellaneous exhibits, for which machinery in motion is indispensable. There are, of course, the usual number of working bakeries and confection stands, glass engraving and brush making stands, jaquard looms, printing machinery, &c., &c. There is also a very fair show of gas engines, the several types shown being the "Otto" engines of Crossley Bros.' manufacture, the "Griffin" type shown by Messrs. Dick Kerr & Co., of Kilmarnock, the "Stockport," &c. The necessary motion for these and other general exhibits, which need not be named, is obtained by means of belting from two lines of shafting—one at each side of the hall—driven respectively by a splendid horizontal compound engine of Messrs. Ruston, Proctor & Co., Lincoln, makers, and one of the "Otto" and one of the "Griffin" gas engines. The shafting is carried on cast-iron A frames 10 ft. high, supplied by Messrs. Kesson and Campbell, Glasgow.

Of exhibits which more directly appeal to our readers, there is not that plentitude which the proximity of Edinburgh to such centres of marine industry as Leith, Grangemouth, Dundee, and even the Clyde itself, would have suggested as only natural. This disappointing feature has already been commented upon when speaking of naval architecture, but it is matter for fuller regret that the same thing applies to marine engineering. Apart from the splendid working model exhibited by Messrs. Denny & Co., of Dumbarton, shown in operation amongst the ship models in the west courts, and already referred to, there is not a single example of marine engine purely in the whole Exhibition. Not a few subsidiary engines, usually indispensable on board ship are, however, in evidence. Messrs. Hawthorn & Co., of Leith, show a patent hydraulic capstan and a patent crank shaft and pin, both of which are noteworthy. Messrs. Brown Bros. & Co., of Rosebank Iron Works, Edinburgh, show their new steam steering gear and telemotor, noticed in our last issue. Mr. George Thwaites, of Stockton, makes a nice display of Snide's patent steam steering gear, plate hole-cutters, &c. Messrs Fargie & Moncur, of Leith, as agents for the Liverpool and London Condenser Co., show that company's evaporators—a detailed notice of which we give on another page—and on their own account show a well-assorted case of steam cocks, gauge-glasses, &c., &c. The Stevens Rudder Controller Co., of 37, Walbrook, London, show various applications of their patent rudder controller to the rudder head gear of steam and sailing vessels. Mr. David Carland, of Ropework Lane, Glasgow, shows a novel type of vertical engine eminently adapted for yachts and launches, and on the same stand they exhibit Cederval's patent protective lubricating box for propeller shafts, a full description of which appeared in a recent issue.

Firms connected with the production of finished iron and steel materials are almost wholly unrepresented; perhaps the only exception being the Tredegar Iron and Coal Co., of Tredegar, Monmouthshire, who show miscellaneous exhibits of the raw materials used in the manufacture of Bessemer steel, including rails, sleepers, fishplates, tinplate bars, &c. Various sections, rolled by the Mechanical Co. Tests to show quality of steel, Tredegar Co.'s celebrated steam coals, foundry and furnace cokes.

In the matter of alloys for constructive and bearing-metal purposes, several well-known firms are represented. The Delta Metal Co., amongst their specialities in other branches, shows Delta metal forged air-pumps rods, piston-rods, shafts, plungers, rams, spindles, cranks, bolts and nuts, &c. An interesting exhibit on their stand is the Légé torpedo, the leading principle of which is that the depth at which the torpedo works is regulated by fins and a tail, which are actuated by the contracting and expansion of air chambers in proportion to the pressure of the water. The Magnolia Anti-friction Metal Co. show their special anti-friction metal for bearings of dynamos and other high speed machinery, which is now also used largely in marine engines, locomotives, &c.

Aluminium, and the various alloys of which this precious metal is now a considerable part, forms the subject of interesting exhibits. The Alliance Aluminium Co., Limited, of Great Winchester Street, London, have a most interesting stall consisting of a raised wooden flooring with a black wooden balustrade, embellished with aluminium and bronze figures and plates. In the centre of the space so enclosed is placed a large aluminium square block, 3 ft. 3 in. long by 2 ft. 9 in. wide; 2 ft. 2½ in. high, on the top of which is placed another square block of aluminium 2 ft. 8½ in. long by 2 ft. 3 in. wide, and 1 ft. 9 in. high, on the top of which is fixed a figure of Mercury holding a pair of scales in one hand, illustrating the difference between aluminium and lead, the weight of each being identical, around this figure are placed specimens of aluminium and bronze in ingots, also a complete set of materials out of which metallic sodium and aluminium are manufactured; glass cases on pedestal containing specimens of aluminium, canopy supported on three columns made of aluminium, and bronze figures, sextants, marine glasses, spars and medals.

In the same department Messrs. Leisler, Bock & Co., 21, St. Vincent Place, Glasgow, show specimens of aluminium and its alloys: ferro aluminium, aluminium bronze, aluminium brass and other articles made therefrom, illustrating some of the uses to which these metals can be put and their superiority over other metals.

Elmore's Patent Copper Depositing Co., Limited, of London, show a great variety of articles to which their patent speciality has been applied with good results; these include—seamless copper tubes of any diameter for high pressure steam, for locomotives, for condensers, refrigerators, &c. These tubes are made of pure, unmelted electro-deposited copper, and are perfectly uniform in density, thickness, tensile strength, and of true circular sections. Copper deposited on hydraulic rams, pump rams, propeller shafts, spindles, &c.

(To be continued in our next.)

Admiralty contracts amounting to several thousand pounds have been placed in the hands of Mr. Ronald A. Scott by the Lords of the Admiralty for the supply of projectors, search lamps, and switchboards.

It is announced from Brussels that the project for connecting that city with the sea, which has been so long in contemplation, has reached a fresh impetus, the Government having decided to give a credit of four million francs towards the construction of the proposed ship canal.

INSTITUTE OF MARINE ENGINEERS.

THE second portion of the lecture on "Electricity" was delivered at the Langthorne Rooms, Stratford, by Mr. Crompton, on the evening of the 20th ult., there being a fair attendance of members present. The lecturer was briefly introduced by the chairman, Mr. Manuel, and then proceeded with his subject, a full copy of which we propose inserting in our next issue. The means of generating power were first touched upon, and leaving out of the question high-pressure water, and turbines for the work, steam was arrived at as being more the source that concerned members. In this connection the Willans and Bumsted high-speed engines were referred to, and the advantage of employing high-speeds was compared to that of using extra coils of wire for producing extra power. With open reciprocating engines, so much in vogue on board ship, only 200 revolutions per minute could be obtained. There was therefore a corresponding loss of power. It was thought, too, with these engines when running compound, equal turning force could not be obtained on the two cranks. This had the effect of causing the lights to jump up and down. With high-speed engines, on the contrary, great regularity could be obtained by those accustomed to them.

The efficiency of the light was next noticed, and referring to the incandescent system the difficulty of obtaining a satisfactory filament in the early days was mentioned. A table was shown illustrating the fact that the resistance of carbon to the passage of current, and its greater suitability for the purpose of lighting therefore as compared with copper was inversely as their conductivities, which are as 1 : 100,000, carbon and copper being the extreme limits of the table. For a lamp to be efficient, it was said it should be cold enough to be clasped in the hand. If this were not the case, it would signify that the filament was being exhausted, and giving off heat. It was hoped in this country that as existing patents expired great improvements would be made in these lamps, and, as an example, it was shown that if the filaments could be made to stand a double resistance, there would be in consequence only half power required in a plant to produce the same light. The simplest form of arc lamps was described, viz., that used in the Royal Navy for search purposes, and also in lighting the Suez Canal. Adjustment of the carbons is made in this case by hand, and this plan was reported to be about as satisfactory as the best mechanical means for effecting this object. The lecturer next described his own form of arc lamp by diagram and model. This consisted of a solenoid with coils surrounding it. When the current became weak in these coils the core inside the solenoid was operated upon to work a pinion gearing into a rack. This rack in turn communicated its vertical motion to the carbons, and so brought them into focus again. With the alternating current both carbons are consumed equally, and the light is even all round. This is not so where one carbon is always the positive pole, and the other the negative. For search lights, where the beam is required in one direction only, the carbons are sloped instead of vertical, and one carbon placed behind the other.

With regard to the modes of distribution of power for lighting, the series and parallel plans were both touched upon. The advantage of the latter system was shown to be due to Ohm's law, and each light would take just the current that was necessary for it, and no more. When the distance is great from the source of power, however, the above law may be interfered with by the resistance of the leads due to the distance, and the lights at the farthest point may therefore get low. With a small installation, such as that in a ship, there is however no drawback from this cause. A great question with the incandescent system was said to be the mechanical impossibility of increasing the length of the filaments or obtaining them thinner in order to increase the light. The different ways of converting high into low pressure current were mentioned, and on the accumulator plan a current of say 100 volts may be given off by the accumulator even while the dynamo is running, which supplies the accumulator at a higher pressure. On board ship both the single and double wire systems of lighting are used. By the first means the skin of the ship becomes the terminal for the current, and less expense is consequently incurred. On land jobs the character of the work is generally judged by the way the leads are protected, but sufficient attention was said not to be paid to this on board ship. A good way of wiring on ships, and which was sure to give satisfaction, was to sheath the cable by a galvanized casing, using the latter as a return conductor. This was simple, and had the advantage of cheapness to recommend it. An important point was safety fuses to prevent short circuiting. If these were not employed the current was raised a hundred-fold by any connection between the two conductors, and a fire would be likely to follow. Instead of fuses being fitted on every branch it was insisted that they should be led to a box in full view. It was said to be very desirable that cleanliness and dryness should always be maintained in the leads to prevent any interruption to the lights. As an instance of the perfection to which dynamos had been brought it was said that in a contract where power was converted into electricity by a dynamo, and then after being conveyed some distance was turned back again into power by means of a motor, the combined efficiencies of the two machines was guaranteed to be not below 84 per cent. Several other interesting facts having been noticed connected with electrical developments in this country and abroad, it was argued that in time we may expect to see power in every worker's house instead of its being congested in factories with the consequent detriment to health.

Mr. McFarlane Gray said it would be impossible to suppose that one hour-and-a-half had elapsed since the lecturer began his very interesting discourse. They had been listening to the words of an educated professor who had shaped his language to suit the audience. He proposed a hearty vote of thanks to Mr. Crompton which was seconded by Mr. Conbro.

Some questions were afterwards put to the lecturer by members. Mr. Rowe mentioned the case of a lead through a beam in a coal bunker which, with the working of the ship had chafed off the insulation and exposed the wire with the result that all the lights went out. In another instance where salt water had reached the wires through the bad quality of the insulator (a specimen of which was produced), galvanic action had been set up, and the ship was in darkness as a consequence. This insulator was said to be very bad, and only had one ply of indiarubber round it. Mr. Storer gave as an example an oil ship, where the leads became saturated with paraffin, wore away, and a fire was caused by the current passing through the intervening space and producing sparking. In reply, Mr. Crompton said that in such a ship the core should be protected by rubber and lead casing outside. If rubber only were used it would dissolve where oil was present. A very good insulation for this purpose was many layers of papers saturated beforehand with petroleum. With regard to Mr. McFarlane Gray's question as to travelling brushes, the public will not pay for refinements of this kind. The end play left in the bearings was generally found to be sufficient to prevent scoring.

The Chairman, in responding to the vote of thanks accorded to him by Mr. Adam, said that the fact of Mr. Crompton's giving his time to them augured well for the future of marine engineering, and he hoped a greater interest would be taken in this subject, now that it had assumed such prominent proportions. Those present would look in a different light upon electrical matters when they knew how the current was generated, and the numerous ways there were of putting a dynamo together. He had always found men were better masters of their work when they knew the method of its construction properly. In high speed engines a certain hum had been observed by him which was not pleasant on board ship. He thought the direct-acting system was better than where belts or friction gear was used. Engineers should make friends with this new element they had to deal with. Progress cannot be stopped. Oil lights gave way to gas, and now it seems as if the latter would in its turn be displaced by electricity. Certainly gas was by no means perfect, owing to the dirt and unhealthiness caused by it. The only difficulty in accepting this, the latest introduction, was the question of cost. He hoped, however, we should have the new light as cheap as gas in the near future. For the sake of engineers he had to say he did not think the engines were the cause of breakdowns on board ship. In his experience the bobbins, wires, and armatures usually gave way, and he had not known a case of an engine failing. He expressed very strongly to electricians the necessity of executing a contract in the best possible manner to ensure confidence. Everything should stand the light of day and be in good order. Engineers have already enough to do on a ship without being called on to rectify faults in the electric department. This concluded the meeting, and the Secretary notified that Mr. Neale of the MARINE ENGINEER had given £25 towards the building fund, a statement which was received with some applause. Mr. Crompton offered to take members to view one of the central stations in London during the summer, and the matter was to be brought before the next Council meeting.

MARINE ENGINE GOVERNORS.

A MEETING of the Institute of Marine Engineers was held on Tuesday evening, 29th of April, presided over by Mr. G. W. Manuel, President, who, after a few remarks on the importance of Marine Engine Governors, introduced Mr. J. D. Churchill as a member of the Institute well qualified to read a paper on this subject. At a previous meeting of the Institute when the question of Marine Engine Governors was discussed Mr. Churchill had been desired to prepare a paper on his own special governor and compound attachment, he had done so and the chairman called upon him to read it.

Mr. Churchill, previous to reading his paper, remarked on the recent unfortunate accident to the *City of Paris*, quoting some of the opinions expressed in scientific papers on the subject, and commenting on the extent of the disaster.

The paper described the principle on which the Churchill governor is constructed and by the aid of several diagrams explained in detail the attachment fitted to compound, triple, or quadruple engines.

It was urged that, as by far the larger percentage of breakdowns occur in fine weather or in weather that cannot be described as rough, the necessity for having a governor attached to engines *always in operation* became apparent. By having such a governor fitted the risks of damage to the rest of the machinery, in the event of a breakdown to one portion, were reduced to a minimum. Cases were cited were, on account of shafts breaking and the engines, relieved of the load of driving the propeller through the water, increased in speed and caused serious damage, whereas, had a governor been fitted in continuous action, the racing of the engines and subsequent damage would have been prevented.

It was pointed out that generally the governor fitted to a marine engine is too small and placed in such a position that it is difficult to keep it fit for service, this being enhanced by the way in which the connecting rods and gear are fitted; all these points were held to be indicative of the necessity that exists for more prominence to be given to this important adjunct to the driving machinery of steamships.

The discussion, which was entered into by a large proportion of members, who were present in good force, was of a lively character and well sustained by Messrs. J. McF. Gray, P. Smith, H. W. White, G. Hudson, J. H. Thomson, S. C. Sage, J. G. Hawthorn, R. Leslie, J. W. Dimmock, and others. The Honorary Secretary read the remarks sent by a member located in Queensland on the subject under discussion.

In the course of the discussion the remarks all tended to show that as a rule the governor and connecting gear does not receive the attention which its importance warrants, considering that, in the event of a breakdown to some portion of the machinery resulting in the engines "racing" away, a good governor may be the means of saving the engines themselves from a serious mishap and the ship from partial or total disablement.

One or two of the speakers spoke very highly of the Churchill governor, which in their experience had been found to give excellent results in practice.

It was remarked very forcibly that the governor was frequently badly fitted and placed, so that it was positively dangerous to attempt to get it into gear when it became necessary to use it in bad weather; thus, when the governor belt is designed to run close to the engine-room bulkhead, and it is necessary for the engineers to go below the platform into the bilges to place the belt on the pulley, it becomes a task both of difficulty and no small danger to life and limb.

It was urged that the attention of those responsible for supplying and fitting governors should be called to the too general lack of supervision in respect to the proper size required for the I.H.P. of engine, the arrangement as to position and connecting gear, and the proportionate strength of the connections. Several facts were mentioned in the course of the discussion which amply justified what was urged.

Votes of thanks were proposed and seconded to Mr. Churchill for his paper by Messrs. J. A. Rowe and R. Leslie, and to the President by Messrs. H. W. White and C. Hudson; these were heartily accorded, when the proceedings terminated.

THE NEW GRAVING DOCK, 355 ft. long, which has been constructed for the Blyth Shipbuilding Co., Limited, was opened last month, when the screw steamer *Regulus*, of Newcastle, was docked.

THE SCREW PROPELLER.

AT the twenty-second ordinary meeting of the session of the Institution of Civil Engineers, on Tuesday, the 6th of May, Sir John Coode, K.C.M.G., president, in the chair, the paper read was on "The Screw-Propeller," by Mr. Syd. W. Barnaby, M. Inst. C.E. Nineteen years ago, when the subject of the screw-propeller was last brought before the Institution, Sir Francis Knowles came to the conclusion that there must be some fixed form of helix better than any other. There did not now appear to be much reason to suppose that there was an advantage in adhering to a fixed relation of pitch to diameter. Not form, but dimensions were of importance, and the determination of the best dimensions was subject to so many conditions that the problem was one of great complexity.

The author submitted the results of recent experimental research so far as they bore upon the solution of this problem. The experiments made by Mr. Thornycroft with model screws were described, and the author's method of tabulating the results was explained. This method consisted in the construction of constants expressing the relation between disk-area, power, and speed, and also between diameter, speed, and revolutions.

They depended upon the propositions that—

1.—The disk-area was proportional to the I.H.P., and inversely proportional to the cube of the speed.

2.—The revolutions per minute were proportional to the speed, and inversely proportional to the diameter. The constants were of the form

$$C_A = \text{Disk-area} \times \frac{V^3}{\text{H.P.}}$$

$$\text{and } C_B = \text{Revolutions} \times \frac{D}{V},$$

where V = speed of screw through the water, D = diameter of screw in feet, H.P. = effective H.P. in the screw-shaft.

Series of constants, corresponding to different amounts of slip, were placed in their proper relative positions under a curve of efficiency. The results of the trials of a number of models of different pitch-ratios were thus treated, each series being assigned its proper position under the curve. In this manner a table was formed comprising the whole of the experiments with a particular type of screw. It was possible to select from it such a pair of disc-area and revolution constants as would give, within limits, any desired number of revolutions per minute for any speed and any I.H.P., and the efficiency could be seen at a glance. Instead of presenting the constants in the form obtained directly from the models, they were so modified that I.H.P. could be used instead of H.P. in the shaft, and speed of ship instead of speed of feed-water.

Corrections could be made for exceptional speeds of wake and ratios of $\frac{\text{E.H.P.}}{\text{I.H.P.}}$, and also for two-or three-bladed screws. Since Mr. Thornycroft's experiments, Mr. R. E. Froude had been working in the same direction, and had made so complete a set of trials that the author had obtained his permission to treat them in the manner described, and a table of constants compiled from them was given in an appendix. As regarded the relative efficiency of large and small screws, if consideration were confined to the propellers alone, apart from the vessels they were designed to propel and the services they were intended to perform, efficiency was independent, within certain limits, of the absolute size of the screw. According to Mr. Froude, the screw for a vessel of 500 I.H.P., and 10 knots speed per hour, might be 10 ft. in diameter, 0·8 pitch-ratio, and run at 138 revolutions per minute; or it might be 15½ ft. in diameter, 2·5 pitch-ratio, and run at 33½ revolutions. Both screws would be credited with an efficiency of 69 per cent.; but the large screw was at a disadvantage when placed in a following stream, on account of the greater difference in the velocity of wake currents which it experienced, and also because of its greater liability to emerge from the water. To maintain a high speed against head winds and sea, a relatively large screw was desirable; the case was analogous to that of a tug. For such a purpose increased diameter should not be associated with increased pitch-ratio. The propeller of 15½ ft. diameter and 2·5 pitch-ratio would probably waste as much power when working against head seas as the 10-foot propeller of 0·8 pitch-ratio. The best proportion would be obtained by designing for a speed less than the maximum smooth-water speed, but such as the vessel might be expected to maintain over an average passage. An account was given of some interesting trials made last year by Mr. Murk Lels for the purpose of ascertaining the thrust of a screw as shown by a dynamometer attached to the thrust-block. The results were set out in the appendix. The overlapping screws of the *Teutonic* were described, and stated to be a success. The author expressed some surprise that triple screws had not been more extensively adopted in high-speed ships of war, and suggested a combination of two screw-turbines with one common screw between them. They would not occupy a greater width than two screws of equal power, and the screw-turbines were well protected by their casings. The centre-screw only would be used for going astern, and the port and starboard engines would require no reversing-gear. A feathering-screw had been designed by Mr. Vogt, in which the blades automatically adjusted their pitch until the pressure on each was equal. A feathering-screw should be more efficient than one with fixed blades behind a vessel. It also augmented the manœuvring powers. A screw with rigid blades offered considerable resistance to lateral movement, because the pressure on the blade, which was moving in the same direction as that in which the stern of the vessel was turning, was increased, while that on the blade, moving in the opposite direction, was reduced. The feathering-screw would offer no resistance to lateral movement. It might be expected to greatly increase the manœuvring power, but at the same time to render a vessel somewhat less steady on its course, and more dependent upon the helm for maintaining it. An adjunct to a screw had been proposed, which consisted of a ring surrounding it, furnished on the inner surface with a number of helical blades forming a counter-screw. The object was to utilize the effect of revolving currents outside the screw's disc. Mr. Froude had last year laid down the proposition that there could be no such thing as suddenness of change from velocity of feed to velocity of discharge, in the case of a submerged propeller; however short a time a propelling surface acted upon the water, the acceleration must be gradual. Starting with the conception of an advancing surface of instantaneous charge of pressure, which he called an "actuator," he showed that the suction in front would be equal to the thrust behind; or that, of the whole acceleration produced, one-half would take place in front of the actuator and one-half behind. Mr. Froude saw no reason why the result should be different with a helical propeller, in which case a screw of uniform pitch would have the same qualities as an ideal gaining-pitch screw. Mr. Thornycroft had given reasons why it would not hold good in the case of a helical propeller, but would be modified by the rotation impressed upon the water, the modification depending upon the amount of rotation. The greater the whirling of the race, the greater would be the suction in front of the propeller. Sir Francis Knowles had said, in his paper of 1871, that negative slip was an impossibility unless the screw were assisted by sails, and other writers had expressed the same view; but Mr. W. Froude had shown that apparent negative slip was possible, and might be expected in certain circumstances. His explanation, however, was intended to apply only to a propeller of increasing pitch, and depended upon the fact that the speed of advance of such a screw was assumed to be equal to the mean of the pitches of the forward and after edges, and negative slip would disappear if the speed of advance of an increasing-pitch propeller were calculated from the pitch of the after edge instead of from the mean. Moreover, it did not explain how negative slip could be obtained with a screw of uniform pitch. But the author was aware of authentic cases with screws of uniform pitch of small pitch-ratios. It was not until Mr. E. Froude read the paper last year that the author was able to find for himself a satisfactory explanation of this phenomenon. The demonstration then given, that, under certain conditions, one-half the acceleration would be produced behind and one-half before a propeller, seemed to supply what was wanting for the construction of a complete theory of negative slip. Although it had been shown to be true only in the limiting case, still a screw of uniform pitch of very small pitch-ratio, which would cause but a small amount of rotary motion, might approach sufficiently near to this condition, and give enough acceleration behind the screw. In other words, it might impart a sternward velocity to the race sufficiently greater than the product of its pitch into the number of revolutions, to produce apparent negative slip.

THE TWIN-SCREW ATLANTIC LINER "NORMANNIA."

A NEW competitor in the Atlantic service was tried on the Clyde last month with remarkable results. She is named the *Normannia*, and sailed on Saturday evening, May 5th, for Hamburg to take her place in the fleet of the Hamburg-American Company, for whom she has been built by the Fairfield Shipbuilding Company at Govan, in the unusually short time of ten working months. It is indeed only twelve months ago that the first proposals to build the vessel were made, and it is difficult to imagine how so enormous a structure, 500 ft. in length, a 57 ft. 6 in. beam, and measuring 8,500 tons, could be put together, with two sets of engines, and furnished with all the innumerable fittings necessary for an ocean-going ship in so short a space of time. No steamer of the same size has ever been produced with such expedition, and few have been delivered, as the *Normannia* was, the very day she was due. The *Umbria*, built in the same yard eight years ago, was put together in fifteen months, and this up to the present time has been regarded as the *minimum* time necessary to build an Atlantic liner of the first class. Another feature of this vessel as regards workmanship consists in the fact that within three days of her leaving the dock she achieved a speed of over 21 knots on the measured mile and of 20½ in a run on Saturday, May 5th, from the Cloch Light to the Cumbrae. Vessels of this character are usually given several days and even weeks running before being put to the severe test of a high speed, but the freedom with which the machinery ran on leaving the dock justified an earlier trial. Whether the speed attained at the trials will be excelled on the Atlantic after she has made one or two voyages is matter for conjecture, but the *Normannia* has realized a greater speed on the measured mile than any other Atlantic liner on her trials, and with distinctly less effort.

The results achieved are the more interesting as illustrating the advance made in ocean navigation from an economic point of view during the past eight years, because while the vessel is, in capacity, almost identical with the *Etruria*, and differs only in a variation of the uses made of the space at command, she has, without increasing the number of the boilers, given a greater speed at a less cost of coal. Like the *Etruria*, she has nine double-ended boilers, with eight furnaces in each, and three funnels, but has no forced draught. She is, however, provided with open fans to ventilate the stokeholes. This is eminently satisfactory, and may lead to engineers abandoning the policy of forcing air through the furnaces, to the destruction of the boiler plates and furnace bars, besides straining the boilers by excessive contraction on cooling.

The engines of the *Normannia* are two sets of triple-expansion cylinders, set vertically, and with a downward stroke of 5½ ft. The diameters of the cylinders are 40 in. in the high pressure, 67 in. in the intermediate, and 106 in. in the low pressure. The steam is worked at 160 lb., and the revolutions at sea will probably be about 85. On some occasions on the trial they made 93, and this figure may be reached in ordinary circumstances when the machinery has become settled. The screws are only 18 ft. in diameter, the smallest of any blades yet put upon a twin-screw Atlantic steamer. The advantages in point of strength, lightness, and durability given by a short blade are obvious, but the handiness of the screws seems also to have increased the speed. This departure from accepted theory was resolved upon by the Fairfield designers as likely to utilize to the best advantage the steam power at command, having special regard to the proportions of the hull, and they assert that the satisfactory result achieved has been largely contributed to by the fact that the Hamburg-American Company imposed no conditions upon them beyond length, breadth, horse power, and passenger accommodation. The horse power contracted for was 14,000, but over 16,000 have been indicated, and the coal consumption is not much over a pound and a half per horse power per hour.

The form of the hull and the number and character of the compartments into which it is subdivided are matters of special interest to the public, having regard to the recent catastrophe of the *City of Paris*. Up to four years ago it was customary to divide large vessels by transverse bulkheads only; and they were pierced in many cases by doors below the main deck. The doors were too often difficult to open and shut, and a case could be mentioned in which it took a couple of hours to close a door with crowbars, and that in a new vessel, when the safeguard was being exhibited to Government officials in hopes of approval. Since then great improvements have been made. Doors have been contrived to close automatically by the removal of a lever, by hydraulic power and by the screw. The necessity for insuring that the door is closed has, however, made it imperative to have control of it from the main deck, and in the case of the *Normannia*, while the doors will all drop automatically by gravitation, they are each under control from the main deck, and can be screwed down without excitement should the automatic action have proved ineffectual. There are 16 bulkheads in the *Normannia*, making 17 watertight compartments, and there are doorways through only five of the transverse bulkheads. These five doors are necessary to procure access to the coal, but communication between the other compartments is procured only by going upstairs to the main deck and down on the other side. The sub-division of the hull, however, does not stop here. Throughout the whole length of the ship the floor of the vessel has a double skin, and the inner floor is throughout 4 in. above the lower or outer bottom, except in the part under the engines, where the intervening space is 7 ft. deep. There are no fewer than 19 of these spaces, so that the hull of the *Normannia* is sub-divided into as many as 36 watertight compartments. These spaces are largely utilized for water ballast, and their contents are controlled by pumps, which are in all cases worked from the main deck, where the donkey engine and donkey boiler for pumping are also placed. This arrangement of the pumps permits of continuous steam pumping in the event of an accident, such as that which befell the *City of Paris*, whose pumps were below the water-line, and therefore useless as soon as they were swamped.

The bulkhead arrangements have other points of interest. It may be remembered that the fires of the *City of Paris* were said to have been extinguished by the influx of water. To put out the fires and stop the engines of the *Normannia* it would be necessary to make havoc of five compartments. The nine boilers are placed three abreast, and each triplet is contained in the centre of three watertight compartments. Two of these compartments in each set are coal bunkers, stretching right across the ship, and each set of three boilers communicates by separate steam pipes with both sets of engines. The boilers are, as before stated, further protected by the double floor and its subdivisions, and thus it will be seen the engineer has three sources from which to draw his steam, besides having the two sets of engines for locomotion. The requirements of the Admiralty, which insist that coal shall be carried along the sides of the vessels for protective purposes, interfere with this desirable arrangement, but it may speedily become a question whether the safety of the passenger and the mercantile qualities of the ship should be sacrificed for the doubtful advantage of being on the Admiralty list. A revision of the Admiralty rules, giving the option to shipowners of providing numerous subdivisions in preference to coal-bunker protection will most certainly be necessary if full advantage is to be taken of improved methods in steaming, and the Mercantile Marine is still to be regarded as a naval reserve. The *Teutonic* and *Majestic*, of the White Star Line, would have been more serviceable ships if their arrangements had not been hampered by Admiralty commands.

The *Normannia* accommodates 420 first-class passengers, 172 second, and 700 steerage, a total of 1,292. Her saloon, which is richly decorated and panelled with paintings throughout by eminent German painters, is 72 ft. long, and, as it is supplemented by another saloon on the lower deck, 380 passengers can be seated at one time. Many of the state rooms are superior in size and accommodation, and several of them are provided with marble baths *en suite*. The ladies' rooms are lavishly decorated, and the second-class accommodation is uncommonly good.

The directors of the Hamburg-American Co. having contracted for a speed of only 19 knots at sea and 14,000 H.P., were naturally enthusiastic on receiving from the builders a boat so much superior in speed to what they had bargained for. Their gratification was given expression to by Mr. Tietgens, the vice-president of the company, in a panegyric on the superiority of the British as colonists, navigators, and shipbuilders. In all civilizing arts, he said, the French, Italians, and Germans were but the pupils of Great Britain; and, however distinguished the generals of other nations, no other but the English could boast of a Nelson, and never would have one. Point was given to these remarks by the knowledge that another steamer similar in purpose to the *Normannia* has been in course of construction at Stettin during the building of the *Normannia*, but she will not be ready for the sea for a twelvemonth hence.

A representative company attended the trial trip. Mr. Burns, of the Cunard Line, was accompanied by Sir W. Forwood, the Marquis of Ailsa, and Lord Howard de Walden. The Inman Line was represented by Mr. Spence, the White Star by Mr. James Ismay, the Guion by Mr. Marsh, the Anchor by Mr. A. C. Henderson, and the Orient by Mr. James George Anderson. Mr. Barnwell, the managing director of the Fairfield Co., presided at the luncheon and proposed the usual toasts.

THE NEW PADDLE STEAMER "CLACTON BELLE."

THIS handsome vessel has just been completed by Messrs. W. Denny & Brothers, shipbuilders, of Dumbarton, to the order of the London, Woolwich, and Clacton-on-Sea Steamboat Co. Limited, for daily passenger service between London and Clacton-on-Sea. In order to test the capabilities of the steamer, a large number of gentlemen made a trip in her on Thursday, May 15th, when she fully justified the expectations of her proprietors. The *Clacton Belle* is a very great advance, both in arrangements and in speed, upon the steamers hitherto employed on the River Thames. During a trial on the Clyde, running over a distance of more than 100 miles full speed, with and against the tide, she made an average speed of 19¼ miles per hour, the speed on the measured mile being over 20 miles an hour. Her principal dimensions are:—Length, 250 ft. by 26 ft. 6 in. breadth by 17 ft. 3 in. depth to top of promenade deck. The vessel will have a No. 3 Certificate from the Board of Trade for trading between London and Clacton during the summer months. The forward part of the steamer is set apart for the second-class passengers, there being a lofty dining saloon below the main deck, well ventilated, both by side scuttles and ventilators from main deck, with all possible conveniences for passengers. The after part of the vessel and the whole of the promenade deck is set apart for the exclusive use of first-class passengers; a lofty and handsomely-decorated social hall being erected on the main deck, extending over a length of 55 feet, and from side to side of the vessel. Sofa seats run along each side under the windows, and the whole apartment is handsomely upholstered in gold friese velvet. Abaft of this hall a ladies' saloon and lavatory accommodation is provided, and is similarly fitted, while at the forward end two Pulman state-rooms are fitted with sofa-seats and tables, easily convertible into sleeping berths, with wash-basins, toilet racks, mirrors, &c., for those who desire this extra luxury. Below the hall is the first-class dining saloon and refreshment bar, well lighted and ventilated from the promenade deck, having sofa-seats, tables, and revolving chairs arranged along the sides. Well-appointed lavatories are fitted for both first and second class passengers, while special attention has been paid to the culinary department. The engines are a set of Messrs. Denny & Co.'s compound surface-condensing, and are supplied with steam by two navy-type boilers. The vessel has a remarkably trim and smart appearance, with a nice rake in her funnel and mast, both of which are adapted for lowering. This will allow the vessel to pass under London Bridge at any state of the tide. The directors have taken the opportunity afforded by the construction of this fine vessel to place the Clacton service on a new and improved basis, and to this end have effected an arrangement with the Victoria Steamboat Association for a joint service between London and Ipswich. Under this arrangement the *Clacton Belle* will perform the daily service between London and Clacton, leaving the Old Swan Pier, London Bridge, every morning, Fridays excepted, at 9.30 a.m., and returning from Clacton-on-Sea in the afternoon. The journey from Clacton to Ipswich will be made by the Victoria Association's handsome steam yacht *Fairy Queen*, specially designed for the navigation of the Orwell, calls being made *en route* at Walton-on-the-Naze and Harwich. Passengers will thus be able to book through to Ipswich and the last-named places by means of the two steamers, and can further continue their journey to Yarmouth and other places on the Great Eastern Railway system under an arrangement with that company for circular tickets. The service will be under the joint direction of Mr. H. R. Spence, of the Clacton, and Mr. Arnold Williams and Mr. Edgar Shand, of the Victoria Co.

LAUNCH OF A PATENT ELEVATING FERRY STEAMER.

MESSRS. WM. SIMONS & Co. launched from their yard at Renfrew on Saturday, May 17th, the new patent elevating ferry steamer which has been designed for the cross-river service at Finnieston. The necessity for some mode of cross-river communication at Finnieston, accommodating carriage as well as passenger traffic, has long been apparent, but it was only after much discussion that the Clyde Trustees fixed upon this new style of ferry steamer as best suited, in their judgment, to meet the wants of the public. A description of the new vessel will be read with interest:—The hull, which is constructed chiefly of steel, is of the following dimensions:—Length, 89 ft.; breadth, 43 ft.; depth amidships, 12 ft. The vessel is sub-divided into thirteen watertight compartments by longitudinal and transverse iron bulkheads. The main deck is iron, and under it accommodation is provided for the crew. Its distinctive feature is an elevating deck platform, besides the ordinary deck, which extends the whole length of the vessel and occupies two-thirds of its width. This platform is supported by six steel columns of box section, and from its lowest position rises to a maximum height of 15 ft. by means of six large steel screws placed inside the upright columns. This ferry steamer presents several novelties in design. One of the most important advantages of a steamer of this type is its being able to embark and land passengers on the quay or landing-place irrespective of the rise and fall of the tide. When the tide is low the elevating deck is raised, and as the tide rises it is lowered. The vessel has accommodation for about 300 passengers, besides eight loaded carts and horses, or the same number of passengers and four loaded lorries and three loaded carts and horses, or if passengers only, 600 to 700. For the transportation of railway carriages and waggons, two lines of steel rails are laid on the part of the platform set apart for the vehicular traffic. Vessels constructed after this principle are well adapted for the conveyance of goods and passengers between the shores and vessels lying off. The passenger accommodation is upon each side of the elevating platform, and the vehicles and goods occupy the central part of the platform. Besides the rapidity and economy in transportation of goods, passengers, vehicles, &c., with such a ferry steamer inclined slips and approaches are dispensed with, thus diminishing the wear and tear on carriages and horses on the incline. There is also an important consideration which the crowded state of Glasgow Harbour renders of peculiar moment, which is that a vessel of this type is not confined to one special berth, but, if necessary, can proceed to another point of debarkation. The propelling and elevating machinery is located amidships, and consists of two independent sets of surface-condensing three-cylinder engines, each set coupled with its own line of propeller shafting, and each shaft carries two propellers. I.H.P. of propelling engines about 320 collectively. Steam steering gear, by Messrs. Alley & M'Lellan, is fitted on the upper bridge and also on main deck, while Brown's patent steam and hydraulic starting and reversing gear is fitted to the propelling engines. In the event of either set of engines being disabled, provision has been made that the remaining set can propel the vessel, thus avoiding delay. Steam is supplied by two horizontal boilers of Siemens-Martin steel, to Board of Trade requirements, for 150 lbs. working pressure. They are fitted with patent-ribbed furnaces. Engines for raising and lowering the platform are separate, but are similar to those for propelling, and are supplied with steam from same boilers. The elevating engines drive two lines of horizontal shafting running fore and aft. On the shafting steel and gunmetal gearing is fitted to drive the elevating screws for raising and lowering the platform. This gearing is so designed that a variation of speed can be obtained as the nature and extent of the load may require. The air and circulating feed and bilge pumps are worked independently of the main engines. The whole of the work has been completed under the superintendence of Mr. James Deas, M.I.C.E., engineer to the Clyde Trustees, and Mr. H. R. Robson.

A large company of ladies and gentlemen were present to witness the launch, those from Glasgow having been conveyed to Renfrew by one of the Clutha Harbour steamers, specially engaged for the occasion. As the vessel left the ways she was named the *Finnieston* by Miss Muriel Mitchell, daughter of Mr. J. L. Mitchell, convener of the Ferries Committee of the Clyde Trust.

DESCRIPTION OF THE METHOD USED IN REMOVING AN OLD DOCK WALL.

(*Unavoidably crowded out of last number.*)

A MEETING of the Institute of Marine Engineers was held on Tuesday evening, the 15th April, presided over by the president, Mr. G. W. Manuel.

A paper by Mr. Joseph Thomas (honorary member) was read, descriptive of the method used in removing the old dock wall at the new entrance of the Royal Albert Dock. Mr. Thomas, previous to the paper being read, briefly pointed out the objects aimed at in the removal of the old wall; he explained the excellent diagrams which were arranged in the hall to illustrate the subject. The basin which it was found necessary to enlarge was surrounded on all sides by walls 38 ft. deep, 20 ft. wide at the bottom and 5 ft. at the top, made of concrete, composed of six parts gravel and one part Portland cement, equal to granite in hardness and strength. The ground was made up to the level of these walls and quays, and warehouses formed thereon.

Several schemes were proposed for carrying out the undertaking, which were explained by Mr. Thomas, but the plan adopted and carried out with every success was dwelt upon at length and formed a most interesting paper, the closing paragraph of which may be quoted as showing the exceedingly accurate arrangements which had been made and carried out so efficiently:—

"The effect on closing the circuit was remarkable, the entire visible length of wall was instantaneously lifted in the air in a perfect line about 6 ft., a crackling roar, a cloud of brownish smoke and a violent surface displacement of the water in the immediate neighbourhood of the wall, was the only visible effect of the vast forces let loose below. So instantaneous was the effect that the chairman of the dock company who closed the circuit, declared the wall fell to pieces before his hand struck the switch."

Several questions were then asked by members and duly replied to by Mr. Thomas, who was accorded a hearty vote of thanks for his interesting paper, proposed by Mr. F. W. Wymer, and seconded by Mr. W. J. Craig.

ON THE INFLUENCE OF THE WEATHER ON PADDLE ENGINES.

A Paper on "The Influence of the Weather on Paddle Engines" by Mr. G. W. Buckwell (member) was then read by the Hon. Secretary, in which a most interesting series of experiments were tabulated, results shown and conclusions drawn from cross Channel trips in two paddle steamers, carried out under different conditions of weather. The results in one case showed that with a smooth sea the average revolutions per minute is 6·2 per cent. less than with a rough sea, and the coal used per I.H.P. per hour is 9·8 per cent. less in fine than in rough weather and the cost of coal per I.H.P. per hour is 9·3 per cent. less in fine than rough weather.

The conclusions drawn by the writer of the paper were that the coal used per I.H.P. per hour will be from 4 to 9 per cent. more in bad weather than in fine. That the cost of coal used will be from 7 to 8 per cent. more in bad weather than in fine, and that supposing a boat can do the passage easily in the time allowed her, she will take more revolutions per minute in bad weather than in fine, but it will be the other way if she has only just sufficient time to do it in if driven.

In the discussion which ensued many of the members present took part, and a vote of thanks was proposed by Mr. J. R. Ruthven, and seconded by Mr. Rowe, to the author of the paper, which the Hon. Secretary replied to, referring to the various remarks and question which had been brought forward in the course of the discussion.

A vote of thanks to the president was moved by Mr. Crook, and seconded by Mr. Wiltshire, and heartily accorded.

It was announced that on 13th May a highly interesting paper, with data from experiments on the corrosion of iron and steel, would be read by Mr. D. Phillips, well known in connection with the enquiry on the deterioration of boilers and the application of zinc; and on May 27th (probably the closing paper of the first half of the season) a paper by Mr. D. G. Hoey on his system of ventilation applied to every department of a steamship, would also be read.

LAUNCH OF A WAR-SHIP AT BARROW.

BARROW has secured the honour of being the first to launch one of the cruisers which form part of the programme of new additions to the Navy embraced in Sir George Hamilton's Naval Defence Bill of last session. H.M.S. *Latona* is not one of the first-class line-of-battle ships, but is one of the fast cruisers which are intended to protect commerce in times of war, and as her tonnage is only 3,400, while her I.H.P. is to be 9,000, it will be readily seen that she will steam well. The *Latona* is the first of three similar cruisers being built at Barrow. The others, which are to be named *Naiad* and *Melampus*, are in a forward state of construction, and will doubtless be launched before the *Latona* is equipped for sea. Lady Edward Cavendish performed the launching ceremony, and at a luncheon held immediately afterwards the Marquis of Hartington, chairman of the Naval Construction and Armaments Co., in proposing success to the ship, reverted to the vast improvement which had been effected in the Barrow Shipyard under the managing directorship of Mr. Bryce Douglas, and said the capacity of output of the yard was quite equal to the launching and equipment of twelve such vessels as the *Latona* in 24 months.

The *Latona* is one of a new type of protected cruisers, her dimensions being as follows:—Length, 300 ft., beam, 45 ft.; depth, 22 ft. 9 in., moulded, with a displacement of 3,400 tons on a main draught of 16 ft. 6 in. The vessel has two funnels and two pole masts with a light fore-and-aft rig, and has a smart external appearance. The hull throughout is built of steel, the rudder, propeller bracket, stem and stern posts being of cast steel. Her engines are of triple-expansion type, having cylinders 32½ in., 49 in. by 74 in. by 39 in. stroke, capable of 9,000 I.H.P. with the boilers worked under moderate forced draught. The boilers, five in number, are of the light type adopted in modern war vessels, cast and wrought steel being largely used in construction. They have an aggregate of 16 in. square feet of heating surface. The closed stokehold system of forced draught is introduced, each stokehold being fitted with two powerful fans, worked by separate engines for the supply of air. The steel protective deck which extends fore and aft is a distinctive feature in this cruiser, the forward part of which runs with a long sweep to the ram of the vessel, of which it forms part. The transverse section of this deck is in the form of a flat arch, the crown of which rises about one foot above the water line at centre of vessel and slopes down towards the sides to a point above 4 feet below the load line. The average thickness on the sloping part is 2 inches with a thickness of 2 inches on the crown. There are placed under the protection deck the engines and boilers, magazines, steering gear, and other vital parts of the ship. Vertical engines are used in the *Latona*, and in order to insure protection to those parts projecting above the deck, a belt of 5 inches of steel armour with 7 inches of teak backing round the engine hatchway between the protection and upper decks. The *Latona* is well provided for watertight compartments, &c. A complete cruiser bottom is fitted for the full extent of the engine and boiler space, the continuity of which is carried forward and aft by the watertight flats forming the magazine and store-rooms of the ship.

The bunkers are filled alongside the engines and boilers by means of longitudinal bulkheads, which extend to the upper deck. There are numerous transverse bulkheads under the upper deck, and the ship is thus divided into about 100 watertight compartments. There are two separate boiler and engine-rooms. The magazines are situated aft of the engine-rooms for supplying of the guns. The steering gear for both hand and steam is fitted np in two separate compartments. Forward of the engines are the magazines for supplying the guns in the fore part of the ship.

Above the protective deck aft are the cabins for the ship's officers, the part amidships being occupied by the coal bunkers, artificers' workshop, wash places, &c., while the part forward is entirely devoted to the crew. Under the poop are placed the cabins of the commander and principal officers, wardroom, &c., the forecastle being taken up by the crew. The armament of the ship consists of two 6-inch breechloading central pivot guns, one mounted on poop and another on forecastle; six quick-firing 4·7 inch central pivot guns—three on each broadside; eight quick-firing 6-pounder guns—four on each broadside—besides one 3-pounder Hotchkiss, and four fine barrel Nordenfelt guns mounted at suitable stations along the sides of vessel. A 9-pounder gun for boat and field purposes is also secured on deck. In addition to these, four torpedo tubes are fitted—one forward, one aft, and one on each broadside under front poop. For controlling the ship in action, a conning tower of steel three inches thick is fitted on after end of forecastle, inside of which all the gear for manipulating the engines, steering gear, guns, &c., is placed. As regards the pumping arrangements, an elaborate system of piping is fitted, extending to every compartment, while the fire service and sanitary arrangements are on the same elaborate scale. A complete installation of electric lighting is also fitted, including three powerful search lights. The crew numbers 252 hands all told.

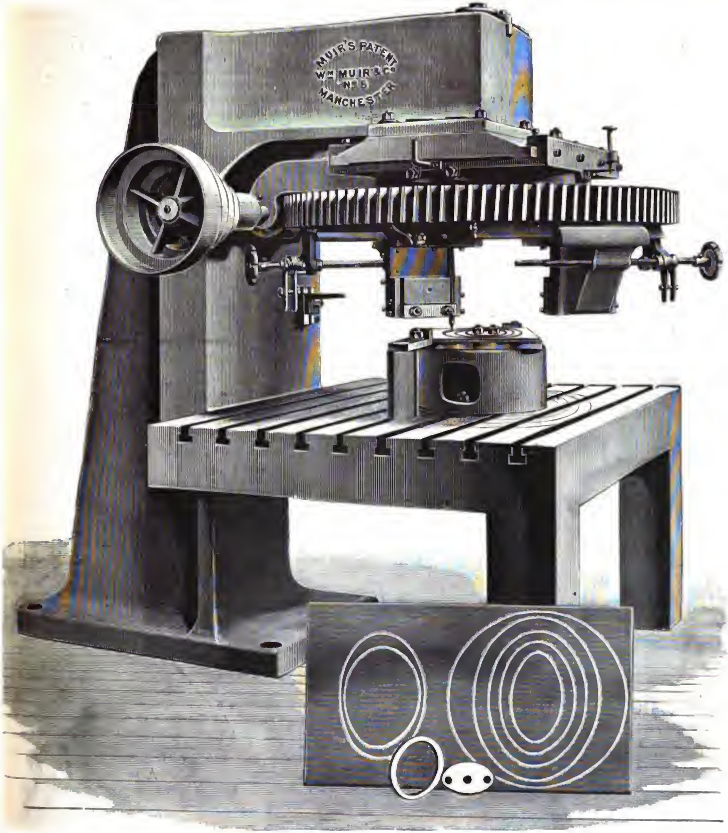
Messrs. S. Baxter & Co., Sandiacre, near Nottingham, are supplying the steam cable gear to the *Latona*, and are to do the same for her sister vessels, the *Naiad* and *Melampus*.

The *Latona*, which forms the subject of our double-page supplement, is expected to be ready for sea in July.

ALFRED MUIR'S PATENT OVAL MACHINE.

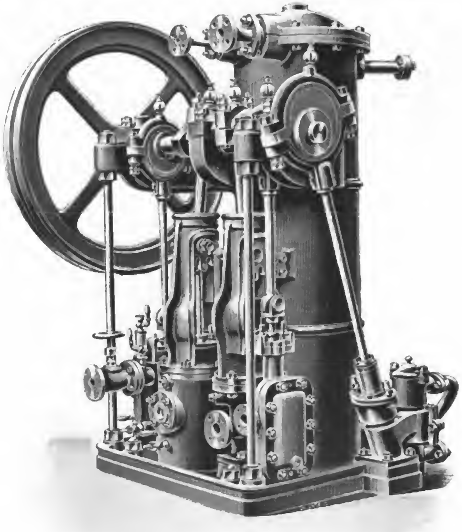
THE accompanying illustration represents a machine, patented by Mr. Alfred Muir and manufactured by Messrs. William Muir & Co., which is being largely adopted by marine engineers, as it is specially designed for cutting out the circular holes of the boiler ends for the flues and also the small mud-holes in the boiler front. The machine is constructed for cutting circular holes with two tools up to 4 ft. 6 in. diameter, and oval holes with one tool from 7 in. by 5 in. to 4 ft. 6 in. by 4 ft. or any variation of these sizes from a circle to an elongation of 6 in. in 1¼ in. plates 3 ft. 3 in. from the edge. The machine is made with independent hollow framing or for bolting to the wall, fitted with rotary slides driven by a cone pulley arranged for eight variations of speed, with worm and worm-wheel; two adjustable tool slides and tool holders with sample tools to each, self-acting horizontally up to

4ft. 6in. diameter and vertically 5in. to work simultaneously when cutting round holes or facing round and oval flanges. Only one tool can be used for cutting oval holes. There is a hand-feed for advancing or withdrawing the tool from the work under operation. The table is 6 ft. long by 5 ft. wide with ⊥ grooves; a sample plate with one oval hole partly cut through is supplied, and the front end of the table is mounted on two cast-iron standards, and the back end is firmly secured to the framing.



MARINE TYPE REFRIGERATING MACHINE.

WE illustrate below a very neat and compact form of ice-making and refrigerating machine, which has lately been introduced by the Linde British Refrigerating Co., Limited, of 35, Queen Victoria Street, E.C., chiefly for use on board ship, but also for installations on land. Several sizes of these machines are made, but the engraving shows an apparatus possessing a refrigerating capacity equal to that of a cold-air machine, delivering about 5,000, or circulating about 7,500 feet of air per hour.



The cold air is produced by means of the evaporation of anhydrous ammonia (N.H.^{3}), which is used in a closed cycle. After evaporation in the refrigerator the vapour is drawn into a pump, where it is compressed and discharged into a condenser, in order that it may assume the liquid state, and become again available for evaporation in the refrigerator. This is the system so successfully introduced by Professor Linde, who many years ago demonstrated the peculiar fitness of anhydrous ammonia for refrigerating purposes, by reason of its very convenient working pressures, high latent heat of vapourisation and low specific heat, which characteristics combine to make it the most economical cold-producing agent known.

In the machine under notice, the small steam-engine for giving the necessary motive power is placed alongside the compressor, a crank shaft with cranks at right angles being common to both.

The compressor is double-acting, and the inlet and outlet of the ammonia vapour is controlled by a single valve, the arrangement being such that all clearance losses are eliminated, and a complete cylinder full of vapour is drawn in and discharged at each stroke. The compressor gland is of special, though simple construction, in order to prevent escape of ammonia. The condenser tank is of cast-iron, and forms the frame of the machine, so that the whole apparatus is self-contained and occupies but very little floor or deck space. The maximum height is only about five feet. The condenser coils are of wrought-iron, made in one length to avoid inaccessible joints, and are tested to a pressure of 2,000 pounds per square inch. A small pump, driven by an eccentric, supplies the requisite quantity of cooling water.

The refrigerator coils are not shown in the engraving. One advantage of the Linde system is that the machine itself need not necessarily be placed near to the spot where the refrigerating effect is to be produced or utilized, and in consequence it is the custom to supply the refrigerator coils separately, and of such form and arrangement as will best suit the particular circumstances of each case. As a rule the use of brine is entirely dispensed with both for land and ship installations, the cooling effect being produced by a current of dry cold air circulated through the rooms or holds, by means of a fan. The air is cooled either directly by the refrigerator coils in which the ammonia is evaporated, or by one of the various patented arrangements of the Linde Co. In all cases provision is made for the removal of snow or frost without interference with the temperature of the holds or rooms.

The larger sizes of marine type machines are generally made horizontal, and have the ammonia condenser combined in the bed plate. The largest machines are made on the duplex system, with arrangements for working either side independently of the other.

The great advantage of dispensing with the use of brine or other pipes in the meat holds is obvious, more especially on board ship, where even a small leakage would probably be attended with most disastrous results.

The White Star liners *Teutonic* and *Majestic* are fitted with refrigerating apparatus on the Linde system, one plant serving for the cooling of the meat holds and for the stores for passengers' provisions, as well as for ice-making, and the cooling of wine, &c. At the present time a large number of vessels are being fitted, notably four large steamers, each with a carrying capacity for 750 tons of frozen meat, and the three new vessels for the Canadian Pacific service to the East. A very powerful meat-chilling plant is in progress for the Mersey Dock and Harbour Board, and installations for meat-chilling and freezing are in hand for New Zealand and other places.

As an instance of what can be done in very hot climates, it is interesting to note that on the Red Sea a Linde plant has been at work for some time, producing extremely satisfactory results, with cooling water at a temperature as high as 102° Fahrenheit. We believe that up to the present time no less than 1,100 machines on the Linde system have been ordered and supplied, while last year alone the sales reached the large sum of £400,000.

THE "COMBINATION" EVAPORATOR.

THE purpose for which evaporators are fitted on steamers are pretty well understood nowadays. At one time we had salt water feed continually going into the boilers, and as the density reached a certain point blowing down was resorted to, to get rid of the salt which had accumulated. With the perfection of the condenser a new era set in, however. It was found the condensed water could be used as feed, and a constant cycle of operations took place from the boiler steam sent to the cylinders, then to the condenser, and back again to the boilers. Still, with the very near perfection of marine engines and their fittings, leakage has to be allowed for in a long run. This varies with different boats, and the care with which they are tended. It is something between one and four tons per day for every 1,000 I.H.P. Whatever the amount may be, has to be made up, and it is found more economical to supply this auxiliary feed by means of an evaporator, and so prevent any salt whatever going into the boiler. It is one of these machines that we propose bringing to the notice of our readers. The subject is important. Without their use a large amount of solid matter is being continually deposited in a boiler, and this leads to heavy cleaning and repairing bills, besides decreasing the efficiency of the boiler as a steam producer, and so adding to the cost of the fuel charges. With triple and quadruple-expansion engines the greatest precautions must also be taken to prevent formation of scale, owing to the high pressure used.

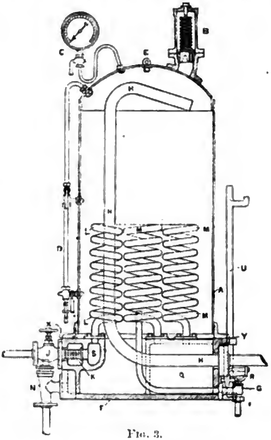


FIG. 3.

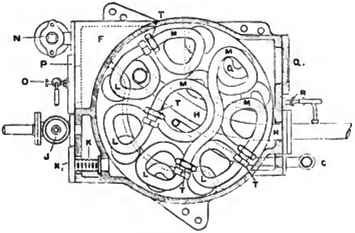


FIG. IV

The "Combination" evaporator is of vertical form, and consists of a lower vessel in which the heating coils and connections are placed, and a dome. These coils are formed of solid drawn copper tubes, and are secured to the cast-iron base by brass flanges and Muntz metal studs. The connections being all on the base, only one joint need be broken to completely expose all the parts for inspection and cleaning. Three supports are provided, which are always in position and form guides when lifting and lowering the dome. Our illustrations, Figs. 1 and 2, show this and the dome resting on the three legs, exposing the interior of the apparatus. Figs. 3 and 4 are sectional elevations. The dome A is of Siemens-Martin steel, with a stamped steel ring forming the lower flange. The fittings on the dome are:—B, the safety-valve loaded to about 10 lbs. per square inch; C, the pressure gauge; D, water gauge, to show the height of the salt water within the evaporator; E, an eyebolt for lifting the dome. None of these fittings need be removed to lift the dome. F, the lower vessel is usually made of cast-iron, but may be made of steel or brass. The connections on the lower vessel are:—G, brass non-return valve for salt water inlet; H, copper internal pipe for the steam generated from the salt water; J, brass valve for supplying steam to the interior of the coils; K, removable brass strainer or dirt arrester to prevent any impurities getting into the coils; L M, the heating coils of solid drawn copper tubes, secured to the lower vessel by brass flanges and Muntz metal studs and brass nuts; N, brass cock for discharging the brine; O, brass salinometer cock for testing the density of the water; P, door for cleaning out salt or other deposit, fitted with Muntz metal studs and brass nuts; Q, water trap for drain from coils; in the larger sizes a door (Q,) is fitted for cleaning; R, brass cock to regulate drain from coils; U, malleable iron guides and supports for dome.

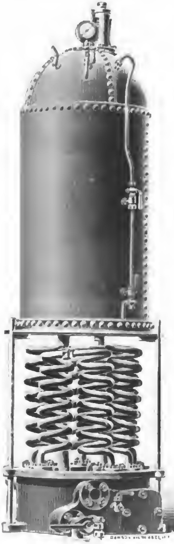


Fig. 1.

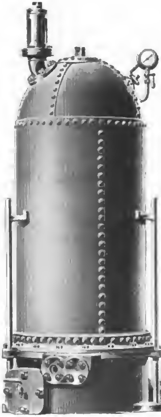


Fig. 2.

The steam for supplying the coils is preferably taken from the reduced steam pipe for the steering engine, so that fresh water may be made in port. It may, however, be taken from the steam chest of I.P. cylinder or from any convenient source. The salt water is taken from the circulating pump discharge. The temperature of this water is usually about 100 Fahr. The steam generated from the salt water enters the evaporator at J and falls as water into the trap Q. The outlets for the steam generated from the salt-water, and for the water condensed in the coils are connected together as shown in Fig. 4, and flow from there to the feed-heater to raise the temperature of the feed-water. By this means the feed is frequently raised to 170 Fahr., and the advantage is apparent. The feed-heater is a separate appliance, its principle being that of an injector condenser.

If the above illustrations be not sufficiently explanatory we may state the method of working the apparatus to be as follows:—Salt water is first pumped into the evaporator to a proper level in the gauge, this height being marked. The water is then shut off and steam turned on at the valve J. The latter passes through the strainer K into the pocket S, and so enters the coil L. After the water in the evaporator has begun to boil, the feed-water is again turned on and regulated to the required supply. It will be noticed there are eight coils. Four marked L are in communication with the pocket S and four marked M are in communication with the water-trap Q. These sets of coils are joined in pairs by the screwed unions T, shown in the plan. The steam from the pocket S ascends the coils marked L and descends the coils marked M, thus heating the water surrounding the coils and becoming itself condensed and falling as water into the trap Q. Should the strainer K become choked with dirt at any time it may be cleaned by removing the door K, without interfering with any other joint. To obtain the greatest efficiency from the evaporator and prevent salt being deposited on the coils, attention must be paid to brining and the density of the water never exceed 2¼/32 as measured by the salinometer. To maintain this density more than one-fourth of the water pumped into the apparatus must be discharged by the brining-cock, which should be run continuously, suitable provision being made for adjusting the flow exactly by a small opening in the plug at the side of the main-way. In addition to continuous brining the evaporator should be blown down completely once each watch, without turning off the steam from the inside of the coils, so that the expansion of the coils would tend to throw off any scale and assist in keeping them clean.

No.	Evaporation per 24 hours.	Space occupied.	Extreme Height.	Approximate Weight without water.	Weight of Water.
1	8 tons.	2' 0" x 2' 0"	5' 4½"	6¾ cwt.	1 cwt.
2	12 tons.	2' 5" x 2' 5"	5' 10"	12 cwt.	1½ cwt.
3	15 tons.	2' 7" x 2' 7"	6' 2"	13½ cwt.	2 cwt.
4	20 tons.	2' 10½" x 2' 10½"	6' 5"	15¼ cwt.	3 cwt.

The above table shows the sizes and weights and the different duties of these evaporators.

We can only add that the system appears to be a very simple and effective one for the purpose. The different testimonials and support it has received alone prove this to be the case, as a very large number of steamers now running have the apparatus fitted. The patent is Morison's, and the makers are Messrs. Richardson, of Hartlepool, the well-known engineers.

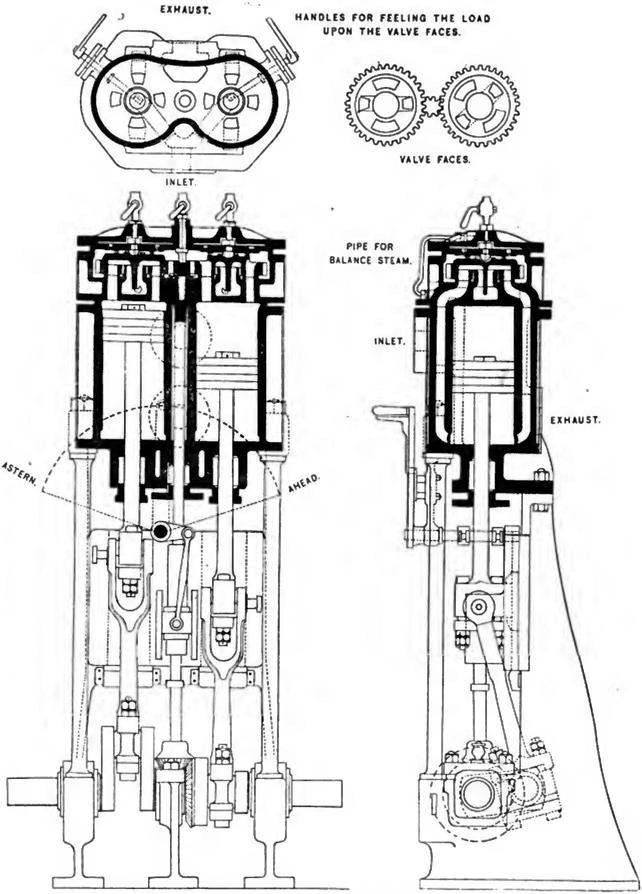
NEW PATENT VERTICAL LAUNCH ENGINE.

MR. DAVID CARLAN, Engineer, Ropework Lane, Glasgow, shows, at Stand 185 in the Edinburgh Exhibition, a new patent vertical engine, reversible, for yachts, launches, lighters, cranes, or for turning the main engines of steam vessels; also non-reversible for driving electric light dynamos and machinery of all kinds. This type of engine, as will be seen from our illustration on page 119, is neat and very compact. It may be made simple, compound, or triple, and may also be made with or without condenser and pumps. The valves are the patent of Mr. K. D. Noble, Dumbarton. The boiler steam is admitted *below* the valve, and tends to push it off the face; but the same steam is also admitted *above* the valve upon a disc of such area that there is a slight excess of pressure downwards upon the face; a copper plate keeping all tight. There is no perceptible wear; and the valve lifts freely to allow escape of water. A handle is provided for feeling the actual amount of pressure upon the face, by easing the valve upwards and slowing the engine. Reversing is accomplished by a brass tube sliding upon the valve spindle, and turning it through a certain angle by means of spiral feathers. This arrangement is made slack and easy, as the pressure is always in one direction. There are also other methods of reversing. The cylinder covers can be lifted off entire, and without disturbing the valves, valve-gear, or piping in any way. The valves can be taken out by breaking only one joint (an exhaust steam one) and without disturbing the cylinder covers or the valve-gear. The reversing gear may be disconnected without interfering with anything else. The adaptability of this novel type of engine for many purposes, land as well as marine, together with its compactness and simplicity of working parts, should earn for it wide adoption.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from April 22nd to May 23rd, 1890.

Allen, Alfred J., staff engineer to the *Excellent*, additional, to date May 10th.
Alton, Geo. B., chief engineer to the *Landrail*, to date May 16th.
Attwool, Geo., engineer to the *Northumberland*, to date May 13th.
Austen, Edwin J., engineer to the *Widgeon*, to date May 13th.
Bartwell, Chas. W. P. S., assistant engineer to the *Howe*, to date May 9th.
Beal, W. E., staff engineer to the *Latona*, to date May 17th.
Bennington, Jno. W., chief engineer to the *Tartar*, to date May 16th.
Bourke, Hy. G., fleet engineer to the *Asia*, additional, for reserve, to date May 9th.
Bryant, Chas. W., assistant engineer to the *Camperdown*, to date May 22nd.
Chope, Wm. D., engineer to the *Bellona*, to date May 9th.
Couper, Ivie A., staff engineer to the *Volcano*, to date May 20th.
Crowle, Joseph N., engineer to the *Iron Duke*, to date May 9th.
Davies, Wm. R., assistant engineer to the *Howe*, to date May 9th.
Eckford, Peter, fleet engineer to the *Northumberland*, to date May 13th.
Edwards, Ernest, assistant engineer to the *Rodney*, to date May 14th.
Fraser, Geo. J., staff engineer to the *Serapis*, to date May 9th.
Frost, J. J., chief engineer to the *Phœbe*, to date May 9th.
Foreman, Felix, staff engineer to the *Devastation*, to date May 13th.
Green, Thos., chief engineer to the *Excellent*, additional, to date May 10th
Hall, Chas. R., assistant engineer to the *Blake*, to date May 9th.
Hart, Alfred, engineer to the *Rodney*, to date May 14th.
Hull, Henry, fleet engineer to the *Hercules*, to date May 13th.
Jennings, Robt. S., assistant engineer to the *Rodney*, to date May 14th.
Johnston, Henry G., staff engineer to the *Camperdown*, to date May 22nd.



New Patent Vertical Launch Engine.—(*For description see page* 115).

Manning, Henry L., engineer to the *Camperdown*, to date May 22nd.

Murray, John A., engineer to the *Sparrow*, to date May 13th.

Nibbs, Chas. W., fleet engineer to the *Monarch*, to date May 14th.

Parry, R. W., assistant engineer to the *Camperdown*, to date May 22nd.

Rolle, Absalom R., assistant engineer to the *Tartar*, to date May 7th.

Sercombe, Francis J., assistant engineer to the *Camperdown*, to date May 22nd.

Shapcott, Richd. A., chief engineer to the *Sirius*, to date June 9th.

Shean, Fredk. E., fleet engineer to the *Rodney*, to date March 14th.

Smith, Alexr. G., staff engineer to the *Iron Duke*, to date May 9th.

Smith, Joseph A., staff engineer to the *President*, additional, for service at the Admiralty, to date June 9th.

Stevens, John G., engineer to the *Hearty*, to date May 8th.

Simmons, Geo. T., chief engineer to the *Melita*, to date May 8th.

Toop, Henry, assistant engineer to the *Iron Duke*, to date May 9th.

Turner, Fredk. S., fleet engineer to the *Howe*, to date May 9th.

Turner, Wm. F., engineer to the *Howe*, to date May 9th.

Walker, Henry J., chief engineer to the *Beagle*, reappointed on promotion, to date April 29th.

Wall, Lewis, assistant engineer to the *Northumberland*, to date May 13th.

Waterfield, Frank, engineer to the *Howe*, to date May 9th.

Watson, Alfred D., chief engineer to the *Espiegle*, reappointed on promotion, to date April 26th.

Willby, Richd. G., chief engineer to the *Excellent*, additional, to date May 10th.

Williams, Stephen B., fleet engineer to the *Assistance*, to date May 3rd.

Winney, Henry T., assistant engineer to the *Rodney*, to date May 14th.

Worth, Fredk., chief engineer to the *Forward*, reappointed on promotion, to date April 21st.

HOAR & BROWN'S HARDWOOD MARKET REPORT, May 24th, 1890.

Teak.—The deliveries for the present month show a distinct improvement upon the quantity delivered during April. The stock has been further increased by the landing of a cargo of Bangkok wood of about 800 loads, and on the 16th inst. stood as follows:—

	Mountain.	Rangoon.	Bangkok.	Totals.
Logs	4,242 loads	4,787 loads	2,098 loads	11,127 loads
Planks	592 ,,	672 ,,	783 ,,	2,047 ,,
	4,834 loads	5,459 loads	2,881 loads	13,174 loads

There is little doubt that prices have now reached a level which must result in considerable losses to shippers, who appear to have recognised the impolicy of their action last year in hurrying forward teak, both good, bad, and indifferent, and are now rigidly keeping down further shipment. It is well known that extensive orders for shipbuilding cannot be withheld much longer, and when consumers realise that prices have seen their lowest, the supply will re-adjust itself to the demand probably in the course of the next few months. The stock of first-class timber is still very limited.

Mahogany.—There has been a large amount of business transacted during the present month, including an extensive order supplied to H.M. Government, and the appearance of the market is encouraging. Several cargoes have changed hands privately at fair prices, and have been mostly distributed again in large lines. The demand remains brisk, and deliveries for the month are very satisfactory. As stocks in first hands are diminishing quickly, prices will no doubt keep very firm.

Cedar.—There is not much doing just now in this wood, although it is expected that some of the old stock may be moved off shortly, when a turn for the better may be anticipated.

Walnut.—There is a bright market for Lumber, and the large quantities leaving the docks every week are very noticeable. There has been a great increase in this trade lately, especially for fair average quality, and prices remain very firm for this class of goods. The log trade has not been doing well for some considerable time, owing, no doubt, to the market being stocked with so many inferior shipments.

Padouk.—Among the many new furniture woods, this has found much favour with manufacturers. Some are using it largely, and are likely to continue to do so, as it takes a good polish, and is only very slightly harder in texture than mahogany.

The present month has been an exceptionally busy one for the Hardwood trade, a large volume of business having been transacted generally. There is a good, steady market, and prices are firm.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

The continued dearth of fresh contracts is now causing many of the shipyards and engine shops, on the Clyde and elsewhere in Scotland, to assume a somewhat barren aspect. Builders are prepared to make very substantial reductions in their prices, as compared with only a few months ago, but owners who really contemplate building are not as yet willing to place their contracts, in expectation of a still greater reduction in prices. Following upon the completion and final handing-over of the magnificent mail steamer *Normannia* to her owners, the Hamburg-American Steam Packet Co., there was a rumour that the Fairfield Co. had received an order from the Cunard Co. for a huge steamship of 9,000 tons! Unfortunately this has been found to be without foundation, and the satisfaction with which the statement—made in one of the Glasgow dailies—was received by the great artizan community of Govan has been but short-lived.

The maritime world is once more agog over the latest-built Atlantic liner, the *Normannia*, above mentioned. The question asked is: "Will she do the trip across 'the herring pond' in the five days prophesied by the late head of the Fairfield Co., Sir William Pearce?" The hopes and interest centring round the *Majestic*, from the stocks of the renowned Belfast yard, and which has scarcely fulfilled what was expected of her, have now been transferred to the new Hamburg-American liner. On her experimental cruise, early in May, the *Normannia* made a speed of something like 20 knots an hour with her engines working up to 92 revolutions per minute. When she ran between Cloch and Cumbrae lights the speed attained was 21¼ knots per hour, with 95 revolutions: and should this rate be maintained on its voyage across to New York, even the smartest of Clyde-built "greyhounds" will have to look to its laurels.

The output of new shipping during the past month, while much less than that for the month previous, is yet a good average—the figures amounting to between 18,000 and 20,000 tons gross. The vessels have mostly been of a moderate tonnage, not a few of them being sailing ships. The only fresh contract which has been placed, or at least announced as placed, is one for a well-decked screw steamer of about 1,700 tons gross, which the Campbeltown Shipbuilding Co. are to build for a Continental firm. She will be classed in the highest grade in both Lloyd's and the Bureau Veritas registries.

A number of the crack Clyde river boats such as the *Ivanhoe*, *Galatea* and *Caledonia*, have completed their fitting out at Greenock for the season and are looking remarkably gay in their bright colours. Great interest has been taken in the new passenger steamers to be placed on station on the Clyde this summer, and it is admitted on all sides that these will form splendid additions to the already magnificent fleet plying on the waters of the Firth.

Messrs. J. Reid & Co., Port Glasgow, have lately launched from their shipbuilding yard the second of the two saloon paddle steamers presently being built by them for the Caledonian Steam Packet Co., Limited, for coast traffic. The vessel, which is named the *Marchioness of Bute*, will be fitted with compound tandem engines by Messrs. Rankin & Blackmore, Greenock. This firm, it may be stated, is exceptionally busy at present fitting machinery into steamers in the East India and Victoria Harbours, Greenock, having no fewer than four on hand, including three handsome paddle "greyhounds" for river purpose, viz., the *Hygeia*, *Marchioness of Breadalbane* and *Marchioness of Bute*. The two latter vessels are improved duplicates of the well-known crack steamer *Caledonia*, and the former is admittedly one of the finest looking vessels of her class hitherto seen on the Clyde, combining the familiar features of the best of Clyde river craft with the special requirements of Australian pleasure traffic. Nautical critics are smitten with the two handsome Marchionesses, but they are positively enamoured of the beautiful goddess of health, *Hygeia*, of which great things are expected. A very high rate of speed has been guaranteed, and the result will be looked forward to with interest. The twin-screw steamer *Apa*, which has just left for South America, is the last of a small flotilla of four steamers, two of which were built by Messrs. R. Duncan & Co., and two by Messrs. Murdoch & Murray, Port-Glasgow, all of them being fitted by Messrs. Rankin & Blackmore with Rankin's patent triple-expansion engines. These somewhat unique vessels have turned out a decided all-round success as to speed, economy of fuel, and great carrying capacity, on an abnormally limited draught of water. They were built to the designs and under the superintendence of Messrs. Morton & Williamson, consulting engineers, Glasgow.

An Industrial Competitive Exhibition is to be organised in the east end of Glasgow, and will be held during the months of December, January, and February, in the buildings and grounds lately occupied as the Reformatory in Duke Street, which can be advantageously adapted for the purpose. There is an open space of about 8,000 square yards available, where temporary buildings may be erected for mechanical, electrical, and other exhibits, which are intended to form a striking feature of the exhibition. It is especially fitting and appropriate that such an exhibition should take place in the east end of Glasgow, where most of the industries of the city are carried on, and where the educational influence of the exhibition will be readily appreciated, and may reasonably be expected to bear good practical fruit. It will provide a healthful stimulus towards the production of works of ingenuity, art, and handicraft, by the skilled artisans of the city, and thus fulfil important functions frequently overlooked, or but little recognized, in the arrangements of many of the more imposing International exhibitions.

On the 15th of May a new life-saving apparatus, the invention of Messrs. Archibald Stewart & Co., 42, Union Street, Glasgow, underwent a series of severe tests in the Arlington Baths, Glasgow, before a large company of gentlemen interested in these matters. The apparatus is for the saving of life at sea, and it takes the form of a comfortable deck chair which possesses great buoyancy when in the water. Among those present were Mr. Stowe, of the Peninsular and Oriental Co., Mr. Herriot, of the Board of Trade, Captain Tassio, Captain Hennike, and Captain Krusse, of the Nord Deutscher Lloyd, Mr. Martin and Mr. Clarke, of the British India Co., Mr. Blackwood, of the Belfast Steamers, and Mr. Dunlop, of the Campbeltown Steam Packet Co. The invention is made in three different forms, and in each of them it was shown to have valuable life-saving properties. In one instance three gentlemen found it impossible to sink the chair, although loading it with their combined weight. One may cling to it in a haphazard fashion, or recline on it comfortably, but in both cases the individual is kept at a safe distance above the surface of the water. In view of the new life-saving Act, coming into force about the end of the year, a large sale is anticipated for this efficient life-saving apparatus.

At the trial trip of the *Palamacotta*, the latest addition to the immense fleet owned by the British India Steam Navigation Co., which took place at the latter end of April, Mr. John Inglis, of Messrs. J. & A. Inglis, the builders of the vessel, made one of the neat speeches for which he is noted. After dinner, and in response to one or other of the stock toasts for such occasions, he said that "the connection of his firm with the British India Co. dated almost from the establishment of the company itself: the contracts being numbered by dozens, and the value of them in millions sterling. In these circumstances it was quite impossible to find anything novel to say on such an occasion. He hoped that the monotony of similar successful trials might long remain unbroken!" This is, at least, a pleasant and harmless way of breaking the monotony of trial trip dinner oratory.

Mr. Inglis, who is president of the United General Associations of the Clyde Shipbuilders and Engineers, was entertained at a complimentary banquet in the Central Station Hotel one night about the middle of April, as a mark of their appreciation of his services in connection with the association during his term of office. Covers were laid for forty gentlemen, and the chair was occupied by Sir Andrew M'Lean.

Messrs. D. & Wm. Henderson & Co., of Elliot Street, Glasgow, have had part of their electric lighting plant remodelled and seven new arc lamps added. Two A gramme dynamos, which were originally made for working two arc lamps each, have had the field magnet coils removed, and each fitted with new armatures, also a spare armature which fits either dynamo, so that, should an accident befall them, this armature can be put into position in a very short time. The alterations have increased the output of the machines considerably, as each dynamo is now capable of working six arc lamps, although at present only working five lamps each. The dynamos are driven by a Tangye steam engine which, before the alterations on dynamos, would not drive six arc lamps satisfactorily, but is now driving ten. This is considered to be a great advance in electric lighting for engine shops, and where good light is essential.

The heaviest casting that has ever been made in Johnstone has been recently delivered to Messrs. Robert Harvie & Co., Parkgrove Ironworks, Glasgow, by Messrs. James Donald & Son, ironfounders, Johnstone. This consists of a half "cheek" of a shearing machine weighing upwards of 24 tons.

Messrs. Baird, Thompson & Co., ventilating, heating, sanitary, and consulting engineers, of Bath Street, Glasgow, and Queen Victoria Street, London, E.C., have purchased the valuable patent rights, models, and working plants, together with the goodwill of the Æolus Waterspray, General Ventilating, Heating, Sanitary, and Electrical Engineering Co., as formerly carried on at High Holborn, London, &c. The business will be continued by Messrs. Baird, Thompson & Co. in all its departments at their London and Glasgow houses, in connection with their business of ventilating, sanitary, and heating engineers, already established there. Several new features calculated to improve the efficiency of the Æolus system of ventilation very considerably—especially for ship installations—are being introduced by the new proprietors.

Dr. Archd. Barr, professor of engineering in the University of Glasgow, has been elected a full member of the Institute of Civil Engineers. His sponsors included Sir Wm. Thomson, Sir B. Baker, the Hon. Mr. C. R. Parsons, Mr. J. Reid, of Hyde Park Locomotive Works; Professor A. B. W. Kennedy, F.R.S., late of University College, London; Mr. J. Strain, railway and dock engineer, Glasgow; Professor Osborne Reynolds, F.R.S., Owens College, Manchester; and Sir J. M. Douglas, the eminent lighthouse engineer—certainly an A 1 list.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—For some time past the near approach of a depressed period in shipbuilding has been steadily indicated in these reports as they have followed each other month by month, and the correctness of the predictions ventured upon are now fully demonstrated by the state of matters which at the moment exists in this and other shipbuilding districts. On the Tyne out of about 90 available building berths no less than 36, or considerably more than one third, are vacant, and taking into account the exceptionally large number of vessels that are now almost ready for leaving the stocks, the probability is that in another month the number of vacancies will be greatly increased. The fact that new orders are more difficult than ever to obtain is testified to by more than one firm to whom application has been made for information on the subject, and though some of the more important firms have occasional enquiries addressed to them, the shipowners invariably press for larger reductions from current rates than can possibly be given while the cost of production keeps at its present height. True, the reduction in the prices of steel and iron has enabled builders to slightly lower their quotations, but as all other descriptions of material still keep at the standard of value that was attained a year ago, and as wages rates are also exceptionally high, no such considerable reduction in price as is being asked for by the few shipowners who seem disposed to add to their fleets can as yet be conceded. There has just been secured, however, by the steel manufacturers a substantial reduction of the operatives' wages, which will doubtless be followed by a corresponding reduction in the price of the commodity, and this no doubt will help shipbuilders to come more nearly into compliance with the wishes of their customers. Not till wages, as well as the cost of material, are reduced however, can the price of tonnage be brought down to the point which may be expected to satisfy shipowners, and to give a new, if not a very powerful, impetus [to business. Amidst the many causes of anxiety for the future that are now becoming apparent, it is pleasant to note that the Scotswood yard, which has for so many years lain in an unproductive state, is being actively got ready for a resumption of operations at an early date. As explained in a former issue, the company who have acquired possession of this spacious establishment, with its equipment of first-rate machinery, are not going into the market as competitors for work in the ordinary sense, but the vessels they intend building for their own special services will for a long time keep the yard fully going, and it would of course be premature to enter into any speculations as to what may follow after. Another satisfactory circumstance to be noted is that Messrs. Wood & Skinner, one of the youngest, but at the same time one of the most enterprising firms on the Tyne, have extended their yard and added largely to their productive facilities. At the moment this firm appear to have an abundance of work, every berth being occupied. Messrs. Dobson & Co., another firm whose commencement in business is of comparatively recent date, have also added to their building space and otherwise improved their working arrangements. Like Messrs. Wood & Skinner, they also seem to have plenty of work, and continue to employ a full compliment of hands. Messrs. Armstrong, Mitchell & Co., who during the past three or four years have built more oil-carrying steamers than all the other shipbuilding firms in the country, have still some half-dozen vessels of that class in progress at their Low Walker yard, besides one which it is understood is intended for employment on an important route, in the passenger and general cargo trades. Messrs. Hawthorn, Leslie & Co., whose yard was beginning to look rather empty owing to recent launches, have just placed the keel for a large vessel, and have resumed frame turning, which for some time had been discontinued. In the adjoining yard of Messrs. R. Stephenson & Co. the framing of a large cargo boat, ordered by Messrs. Wilson, Sons & Co., of Hull, is far advanced, and the construction of the cruiser which the firm are building for the Admiralty is being rapidly proceeded with. This vessel is likely to be among the earliest of the number now building at different centres, that will be put into the water. The firm of Messrs. C. S. Swan & Hunter is the only one on the river, Palmer's Company perhaps excepted, that can be said to be as busy as at any former period. Skilled labour, which was abnormally scarce a few months ago, is now plentiful enough, and the firm just named, as well as others, can get without difficulty as much, or more, than is needed. At Messrs. Schlesinger & Davis's yard, which is at present quite empty, there is a prospect of some of the berths being occupied shortly, as the firm are said to have secured orders for some small vessels. Palmer's establishments at Howdon and Jarrow continue to show great briskness, and at Messrs. Readhead's yard, Tyne Dock, there is also an appearance of activity. Four out of five berths are at present occupied, and the firm have other vessels to lay down. In the repairing establishments there is generally a fair amount of work, the Wallsend Slipway Co. being particularly busy in this line. Among recently introduced labour-saving contrivances, the pneumatic caulking tool is the most remarkable. Of this ingenious and singularly effective machine an eminent Tyneside firm who adopted it some time ago have in reply to an enquiry written as follows:—"With regard to the pneumatic caulking tool, we have tried it, and are satisfied with the quality of the work done by it. So far as economy of working is concerned, we have been hampered by the unwillingness of our caulkers to give it a fair trial. On time they have not allowed it, we think, to do as much work as it is capable of doing, and up to the present they have steadily refused to use it on piece. It is therefore premature to give a definite reply as to the cost of working with the tool. As already stated, however, we are satisfied with the caulking done by the tool, and we may add we think the men oppose it because they know it will do its work well, and are afraid of its being generally adopted, and our opinion is that it will be quite a success in shipbuilding." Messrs. Crossley Bros., of "Otto" gas engine fame, are the manufacturers of this machine, and in such hands its ultimate success can hardly be a matter of doubt.

Engineering.—Messrs. Black, Hawthorn & Co. are just now engaged in fitting the engines in the s.s. *Asloun*, built by the Sunderland Shipbuilding Co. for an Aberdeen firm. In this and other establishments where marine work is the leading speciality, business is still brisk, but the outlook for the winter is by no means encouraging, as no new contracts are coming in to replace those that are being completed. Messrs. Ernest Scott & Co., of the Close Works, are still receiving enquiries in respect of their various engineering specialities, and in their electric lighting department great briskness continues to exist. Messrs. Donald & Co., engineers, &c., have opened premises at No. 56, Close, in which the manufacture of a new lubricator (for which there appears to be a great demand), as well as other engineering accessories, is now being actively carried on. Messrs. Wailes, Dove & Co., whose offices are also situated in the Close, are experiencing a steadily increasing demand for their Bitumastic Paint and other products. Messrs. Geo. Angus & Co., the well known manufacturers of "Amianthus cloth packing," rubber valves, and other specialities for marine engines, continue to be very busy, and have had to further increase their productive power. The great Elswick Works of Messrs. Armstrong, Mitchell & Co. keep as busy as ever, and the establishment of Messrs. John Spencer & Sons, at Newburn, also maintains an appearance of full activity. It may be stated that Mr. Joseph Stone, a gentleman who for many years was engaged in the commercial department of Messrs. Abbot & Co.'s Works, Gateshead, has recently been appointed secretary to Messrs. Spencer & Sons, in succession to Mr. Ramsay, who has transferred his services to a London engineering firm.

THE WEAR.

Shipbuilding.—The fact that the beginning of the depression is being felt on the Wear is plainly demonstrated by several concurrent circumstances. In the first place it has transpired that in two or three yards speculative building is being resorted to as a means of keeping the machinery going, while in other cases vacant berths are becoming unpleasantly frequent. The most significant circumstance of all, however, is that at one establishment a reduction of wages has been demanded from a section of the workmen, and though no general demand of the kind has as yet been put forward, the incident referred to seems to indicate that the whole body of shipbuilders will soon take similar action. There may, of course, be special reasons why a reduction should be demanded in one case though not in others, but whether this is so or not, it is quite certain that wages cannot long escape the curtailing process which necessarily follows diminishing work. In another yard on the Wear a dispute as to whether shipwrights or joiners should do certain work has caused considerable inconvenience for some time past. This is a question which has produced much ill-feeling between the two bodies mentioned, and as it is found impossible to adjust matters to the satisfaction of both, there is reason to fear that in the future, as in the past, it will prove a fruitful source of embarrassment to the employers. Among other changes now going on is the larger employment of gas instead of steam as a motive power in shipyards. Some time ago Messrs. Pickersgill put down a large "Otto" gas engine to drive the machinery of their greatly extended establishment, and now the Sunderland Shipbuilding Co. have followed suit by purchasing a 20 H.P. "Otto" through Messrs. Crossley's agency in Newcastle. This will be the third yard on the Wear in which the machinery will be driven by "Otto" gas engines, and from the favourable reports current as to their economical and effective working, it is probable that the number of establishments adopting them will soon be largely increased. The North Sands yard continues to be quite busy, the whole of the six berths being occupied with vessels of large tonnage. Messrs. Short Brothers have also a full supply of work, nearly all the vessels on the stocks being to the order of local owners. The state of work at the Deptford yard continues to be satisfactory, and at Messrs. Doxford's establishment quite exceptional briskness may be noted. Messrs. R. Thompson & Sons have had a good deal of repair work to deal with lately, and their graving dock at Sunderland Bridge has been almost constantly occupied.

Engineering.—At the Palmer's Hill Works business is still very active, and the other marine engineering establishments in the district are equally well off for work. In all cases recently launched vessels are being fitted with their machinery and boilers. Mr. A. A. Rickaby of the Bloomfield Engine Works continues to have a large demand for his patent piston packing, and recently he has had some important contracts in hand for repairs to colliery engines and pumps. His establishment is now quite full of work, a large part of it consisting of accessories used in connection with steamship machinery. Iron foundries are still fully employed, and in the forges, though work is lessening, the absence of new orders is not as yet seriously felt. The Monkwearmouth Iron Works are up to the present going full time, orders for Bell & Rockliff's patent sections contributing largely to the volume of trade. At the Castletown Steel Works business is also pretty good. The miners of Monkwearmouth Colliery are agitating for a seven hours shift "from bank to bank," and it is feared that on the expiration of their notice demanding the same, a strike may take place. As an outcome of the recent dispute concerning the "12 o'clock Saturday," an effort is now being made to establish a Conciliation Board for the engineering trade, through the instrumentality of which it is expected that any disputes which may in future arise between the employers and the workmen will be amicably settled. A meeting of operatives' representatives will shortly be held in Sunderland to discuss the matter, and subsequent conferences with the employers will doubtless be arranged for. It is needless to say that the establishment of such an institution would be hailed with satisfaction by all classes.

The Hartlepools.—Though the incident scarcely comes within the scope of a trade report, it would almost seem ungracious when speaking of the Hartlepools to ignore the fact that the honour of knighthood has just been conferred on Mr. William Gray, the head of the well-known firm of Messrs. W. Gray & Co., Limited. The distinction can add little to the respect in which Mr. Gray is held in the town whose prosperity is mainly due to his enterprise, as well as in many other parts of the world where his worth is known, but it will nevertheless be appreciated as, in some degree, a recognition of services, the value of which it would be difficult to correctly estimate. The whole of the shipbuilding yards at the Hartlepools continue busy, and Messrs. Withey & Co. have just put down a 14 H.P. "Otto" gas engine to drive a portion of their machinery. During the month Messrs. T. Richardson & Sons have engined at the sheerlegs the following vessels:—the s.s. *Zampa* for Messrs. Herskind & Wood, West Hartlepool. This ship has been fitted with triple-expansion engines, having cylinders 22 in., 37 in., 61 in. diameter, by 39 in. stroke, and two single-ended boilers of large size, adapted for a working pressure of 160 lbs. The engines have been superintended during the manufacture by Mr. J. R. Fothergill, superintendent engineer for the owners, and are fitted with Morison's patent evaporator and feed heater. The s.s. *George Allen* for Messrs. Westoll, of Sunderland, fitted with engines having cylinders 21 in., 35 in., 58 in. by 36 in. stroke, and one large double-ended boiler, 160 lbs. working pressure. Mr. Stansfield, engineer to the owners, has superintended the manufacture of the machinery. This vessel has also been fitted with Morison's evaporator and feed heater. On May 13th the s.s. *Monrovia* had a most satisfactory trial trip. The vessel, which was built to the order of Messrs. Elder, Demster & Co., of Liverpool, is fitted with triple-expansion engines, which, on trial with half cargo on board, indicated 1,050 H.P. Mr. Wilkie, the superintendent engineer, expressed himself as highly satisfied with the whole of the machinery. It may be added that the temperature of the feedwater was found to be 200°. On May 15th the s.s. *Storm King*, owned by Messrs. W. Ross & Co., London, had a successful trial, the mean of four runs over the measured mile showing a speed of 12·86 knots, with 2,280 I.H.P., a result which was considered highly satisfactory by all concerned. Mr. Cassel, the superintendent, who was present at the trial, was thoroughly satisfied with the working of the machinery. At the Central Engine Works the usual number of steamers have received their engines at the sheerlegs during the month, and several highly successful trial trips have been run. The s.s. *Lizzie Cory*, built by Messrs. Irvine & Co. for Messrs. J. S. Allison & Co., West Hartlepool, and fitted with engines from the Central Works, proceeded on her first voyage and has made an excellent record, carrying 1,700 tons at a speed of nine knots on rather less than 6 tons of north country coal per day. The s.s. *Bussorah*, built by Messrs. Wm. Gray & Co. for Messrs. Thomas Appleby & Co., West Hartlepool, and fitted with Central engines of 1,000 I.H.P., proceeded on her first voyage to Bombay, and has made a splendid run as far as Malta, everything being in first-class order, and no water having been required on any bearing whatever. The s.s. *Fulham*, built by the same builders for Messrs. Watts, Ward & Co., of London, and having Central engines of 750 H.P. made her first voyage to Antwerp, everything working splendidly. The s.s. *Odin*, of Christiania, went to sea after being fitted with new boilers at the Central Works. The s.s. *Langol*, built by Messrs. Wm. Gray & Co., for Messrs. Bennett & Son, of Grimsby, carrying 3,450 tons and fitted with Central engines of 1,000 I.H.P. went on her trial trip on May 19th, being partly loaded, when a speed of 12 knots was attained, everything working in the most perfect manner, without any water on the bearings. The s.s. *Norna*, built by Messrs. Edward Withy & Co., for Messrs. Herskind & Woods, has been fitted at the sheerlegs with engines quite similar to those of the s.s. *Langol*. The s.s. *Tetartos*, of Flensburg, has had her old compound engines and boilers taken out, and a complete new set of Central triple-engines of 1,100 H.P. fitted in their place. The s.s. *Sestao*, built by Messrs. Wm. Gray & Co. for Spanish owners, has been fitted with engines of 750 H.P., and two boilers have been completed for a vessel building on the Tees. Whilst the foregoing shows that the activity experienced at the Central Engine Works during the past twelve months has up to the present been pretty well maintained, we learn that orders are exceedingly difficult to secure, even though prices have fallen, and that the order-book is getting very bare. Consequently in the earlier departments of the work the number of hands is being rapidly diminished, night work having already been dispensed with in the boiler shop.

Stockton.—At this centre shipbuilding continues up to the present fairly active, but few new orders are being booked. Since April 18th the following vessels, engined by Messrs. Blair & Co., have had their trial trips:—The s.s. *Newby*, built by Messrs. Ropner & Sons, of Stockton, for Messrs. Ropner & Co., of West Hartlepool, having engines of 160 H.P. nominal, with cylinders 21 in., 35 in., 57 in., by 39 in. stroke. The s.s. *Hounslow*, built by Messrs. Wm. Gray & Co., West Hartlepool, for Messrs. Watts, Ward & Co., of London, having engines of 190 H.P. nominal, with cylinders 23 in., 37½ in., and 61½ in., by 39 in. stroke. The s.s. *Girdleness*, built by Messrs. Richardson, Duck & Co., Stockton, for Messrs. Farrer, Groves & Co., of London, having engines of 150 H.P., with cylinders 21 in., 34 in., 56 in., by 36 in. stroke. The s.s. *Theresa Heymann*, built by Messrs. Ropner & Son for Messrs. McNab, Rongier & Co., Odessa, having engines of 170 H.P., with cylinders 21½ in. 35½ in., 58½ in. by 39 in. stroke. The whole of these engines are constructed to work at 160 lbs. pressure of steam, and on their trial trips gave full satisfaction. The firm have just fitted with a complete electric lighting installation the s.s. *Gulf of Suez*, belonging to the Greenock Steamship Co., this being the thirteenth vessel which they have so fitted for the same owners. Messrs. Riley Brothers, boilermakers, &c., are extremely busy, and continue to be pressed with enquiries, especially for their well known marine type donkey-boilers.

Middlesbro'.—Messrs. Raylton, Dixon & Co. are still busy, but on work contracted for many months ago. They are now putting down a small steamer to be employed as a trawler, and this appears to be the only new contract they have to deal with. Messrs. Harkess & Son launched, on the 21st ult., two steam trawlers from the same berth, and they have now in hand a vessel of 1,000 tons, being plated, and one of 2,000 tons, for which the frames are being turned. The firm have just secured an order for three galvanized steel barges, to be employed in trading on the Zambesi river. There is just now very little repair work at this centre, and the outlook for the shipbuilding industry is on the whole unpromising.

Engineering establishments continue to be fairly well employed, and a considerable pressure of work still exists at many of the foundries. Steel works are also maintaining a show of full activity.

NORTH-WEST OF ENGLAND.

Barrow.—There is no change to note in the condition of the shipbuilding and engineering trades of this district. The large yard of the Naval Construction and Armament Co., Limited, is as busily employed as it can possibly be in all its departments, and the business in hand and the activity maintained is such as to guarantee a continuance of the present state of things for some time to come. No new orders are reported, but there is a good outlook, although, as a matter of fact, the demand, generally speaking, is very weak and uncertain. It is felt that too much tonnage has been built, and it is only in special cases where shipbuilding companies are specially well placed that hopes of a continuance of good trade are entertained. There are indications that the activity at the Barrow yard will be maintained, as there is great pressure for the delivery of the orders already in hand, and as soon as prices of material have eased down a little there is a certainty of new orders. In the meantime the hands of builders are very full of work. It is gratifying to find that the price of steel building material is going down, the quotations at the close of May being £6 17s. 6d. for plates and £6 7s. 6d. for angles, net f.o.b. These cheaper prices are a big inducement to owners who must have deliveries of new ships, and there are those whose interest it is to build while prices are low. There is a very brisk state of things in the engineering and boiler-making departments, and there is no scarcity of new work, for not only are orders of considerable magnitude in hand for the new steamers being built, but there are repair orders and the tripling of several old steamers to keep the marine engineering department very briskly employed for some time to come.

THE MERSEY.

THE condition of trade throughout the shipbuilding and marine engineering industries in this district remains without any very appreciable change from what we reported last month. There is still an absence of new work of any moment giving out, and both shipbuilders and marine engineers for the most part are simply kept going, completing the contracts they have on their books. These are necessarily gradually running out, and at present there is no prospect of their being replaced with new work at all sufficient to keep the shipbuilding yards and marine engineering shops anything like fully employed. The continued unsettled state of the iron and steel trades with the persistent downward tendency in prices, in fact for all descriptions of raw material required for shipbuilding or engineering purposes, may account in very large measure for the holding back of further orders for new vessels, and until the iron and steel markets have settled down to something like steadiness as regards prices, there is little doubt, that even where there are orders to be placed, these will be held back as long as possible. Whilst, however, prices continue to recede, wages are not only fully maintained at their present high level, but movements continue in various directions with the object of forcing them up still higher. The returns of the engineering trades unions' organisations, although they are beginning to show some evidence that there is decidedly less pressure for workmen, do not as yet record any appreciable falling off as far as present actual employment is concerned, and in the Lancashire district the number of out-of-work members on the books of the principal societies remains exceptionally low, the Amalgamated Engineers having not more than 1¼ and the Steam Engine Makers' Society not more than ½ per cent. of the total membership in the above district on the books in receipt of out-of-work support. The workmen consequently do not seem to at all appreciate the fact that although there may be still sufficient work in the shops to keep them fully employed, there is a decided slackening off as regards new work in prospect, and they show no disposition to assist the employers in placing them in any more favourable position for securing orders at the very considerably lower prices at which they could only now be obtained. So from this they seem rather to add to the difficulties of employers, and as illustration we may mention that in one of the shipbuilding yards on the Mersey where vessels are being completed without their berths being taken up with new orders, the joiners engaged on one vessel which is shortly to be launched struck work for a further advance in wages of 1s. 6d. per week. The firm being under the necessity of completing the vessel in a specified time were compelled to give way to the demands of the men, but the result will simply be this, that immediately the vessel is completed the men will be discharged and they will find that the firm have no other new work upon which they can be engaged.

Messrs. Laird Bros., of Birkenhead, are still very busy on important orders, chiefly for the British and Foreign Governments, but apart from these they are getting really no new work. There have been a few enquiries, but these do not seem to have resulted in anything of importance being placed. Messrs. T. Royden & Sons and Messrs. W. H. Potter & Sons are completing two vessels for Mr. Alfred Holt, one the *Saladin* and the other the *Gorgon*, the engines for both of which have been built by Messrs. Fawcett, Preston & Co. For the *Saladin* the engines are compound surface condensing, with 22 in. and 55 in. cylinders, by 40 in. stroke, and they are supplied with forced draught arrangements. For the *Gorgon* the engines are compound surface condensing, with cylinders placed side by side, the high pressure cylinder being 21½ in. diameter, the low pressure 46 in. diameter, and the stroke 3 ft.

In both the iron and the steel trades business continues in a most depressed and unsettled condition, with a further considerable easing down in prices during the month. Just for the present, with the holidays, the month closes with business practically suspended, so far as this immediate district is concerned, when the Whitsuntide stoppages of work and general business operations extends over fully a week, and consequently prices for the moment are little more than nominal, as there is practically nothing doing to really test the market. Whatever business, however, is being got, it is competed for at excessively low-cut figures, and it is very difficult to give any actually fixed price at which buyers with orders of any weight could place them out. There is a rapidly diminishing margin between the prices that makers are willing to accept to secure business and those which have been current in the market for iron taken out of store or second-hand parcels, but makers are still, to a large extent, kept out of the market by the keen underselling of merchants and dealers. In pig iron, 50s. less, which would now have to be taken for local or district brands delivered equal to Manchester to secure any business, and in outside brands good foundry Middlesbro' could be bought readily at about 50s. 6d. to 50s. 10d., and Eglinton at 54s. to 54s. 6d., net cash, delivered equal to Manchester, with the last named brand offering, delivered at the Lancashire ports at about 49s. 6d. per ton net. In manufactured iron, merchants are underselling at extraordinary low prices, and ordinary crown bars are being offered for delivery in the Manchester district at £6 15s. per ton, makers not quoting under £7 to £7 5s., with their nominal list rates in some instances 5s. to 10s. per ton above even these figures. In steel, hematites do not now average more than 65s. less sh. for good foundry qualities delivered in the Manchester district. For manufactured steel prices are weak, the better qualities of steel plates suitable for boiler making purposes having declined very considerably during the month. During the last week or two there has been a little more doing, boiler makers having given out moderate orders when they could get in at low prices. Makers are now quoting about £8 15s. to £9 per ton for delivery to consumers in the neighbourhood of Manchester, but buyers with orders of any weight to give out could place them at under even the minimum figure. In steel ship plates there is still an almost complete absence of any business coming forward to afford any test of prices, and these can only be quoted nominally at something like £7 10s. to £7 15s per ton, delivered ex steamer Liverpool, supposing buyers had any considerable orders to give out.

In the metal market the recent advance in the price of copper seems to have stimulated business to some extent, and there have been a few more orders given out, with the result that prices for manufactured goods have hardened to some extent, copper tubes having been advanced a farthing per lb. For delivery in the Manchester district prices now average for solid steam brass tubes, 7¾d. per lb.; solid drawn brass surface condenser tubes, 8¾d.; solid drawn copper tubes, 9½d. to 9¾d.; brazed copper steam tubes, 8¾d.; brazed brass machine tubes, 7½d.; yellow metal condenser plates, 6½d. to 6¾d.; brass wire, 7d.; copper wire, 8¾d.; rolled brass, 7d.; sheet brass, 8d.; cast composition sheathing nails and spikes, 7d.; red metal ditto, 9d.; wrought copper rivets and washers, 9¾d.; wrought copper boat nails from 9¼d. to 10¼d. per lb., and copper ingots are quoted £61 per ton, with copper sheets £66 to £67.

In the timber trade imports of most articles continue heavy; the deliveries, however, have been fairly satisfactory, but prices generally are lower and sales difficult to effect. Stocks are much too heavy, and it is desirable that spring shipments should be on a moderate scale until present stocks are reduced.

The coal trade has quieted down very considerably during the month, and there has been a more or less general easing off in prices, good ordinary qualities of steam coal delivered at the ports on the Mersey not now fetching more than 10s. to 10s. 3d. per ton, the minimum figure representing more nearly the average price.

WELSH NOTES.

THE chief event of the month here has been the issue of D. Davis & Son, the owners of some collieries, of which Ferndale is the chief, as a limited company. The capital has been more than fully subscribed locally, not to mention the applications from a distance. It is naturally expected that this success will have the effect of bringing forward more Welsh colliery owners desirous of selling their property to the public. The next company is to be the Penrhiwceiber, which will have, as a public company, a capital of some £360,000. The colliery is an extremely good one—to our mind, far better than Ferndale, and should be well taken up. Ferndale is a somewhat old property, the "cream" has surely been taken off by this, whilst Penrhiwceiber is a comparatively new affair. Possibly the Ferndale shares will go to a premium, but this does not necessarily mean that the undertaking is a particularly good one.

The Albion Colliery, owned chiefly by Messrs. Ebenezer Lewis, P. A. Vyvyan-Robinson, and M. Cope may also shortly be put upon the market. We understand, the property is a good one—good enough to keep, in fact—which is probably the reason why it was before London buyers some few months since at about £400,000. That this colliery is in the market has been denied by some people named Rooks & Co., and there are Cardiff people who want to know what these people have to do with the colliery. In referring to this particular point in the business we are merely noting Cardiff gossip.

It appears to us that trade in Welsh collieries has been spoilt by that peculiar course pursued by some owners to which we referred a few months since. The owners were willing to sell; there were, and are for the matter of that, any number of harpies in the city willing to spoil anything for the sake of a commission; these men succeeded in getting hold of the Welshmen with the result that the latter were very soon tired of being introduced to "my friend Mr. Blank, who has a friend who knows a buyer," so that when there is a chance of real business they fight shy and propose terms calculated to warn off any buyer, whither *bona-fide* or otherwise.

H.M. Consul at Galatz writes home that the bar-iron used in Roumania, which used to be supplied from Wales, is now chiefly supplied by Belgium and Germany. This change he attributes to the better way in which the Continental makers are represented amongst consumers, and not to difference in price or quality. How is it then that within the past few months bar-iron made in Belgium has actually competed successfully with Staffordshire and Welsh bars in Wales? As a matter of fact we should say the less said about the quality of the Welsh bar-iron the better. Of course Welsh bars can be delivered at Welsh ports more cheaply than can Staffordshire, and yet we know ship repairers in Wales who will not use the local stuff, notwithstanding the lower prices.

At the last meeting of the Newport Chamber of Commerce it was stated that the Bute Docks Co. had succeeded in obtaining the powers granted to the Rhymney Railway Co. in 1882 to tap the Monmonthshire valleys. Naturally this a sore subject with the Newport people, but it appears to us that they have been too slow in bringing forward their objections. It was only to be expected that the Bute people would try everything possible to secure trade which would help to make up for that lost by the Barry opposition, but it was known some time since that they intended to secure the Rhymney powers referred to if possible, and if the securing of these powers damage Newport, as they certainly will, then Newport has only itself to thank.

The Newport coal shipments for April showed a falling off of 10·17 per cent. as compared with the previous April; Swansea showed a decrease of about 7 per cent.; and Cardiff an increase of 11·26 per cent. As a matter of fact, the only South Wales dock pure and simple which showed an increase was Swansea. In the Cardiff returns are included Barry and Penarth; in those of Swansea are included small places like Port Talbot, Neath, Hinton Ferry, and Porthcawl. As a matter of fact, Swansea's exports for April showed an increase of about 35 per cent., and with the opening of the Rhondda and Swansea Bay Railway this should be improved upon.

By the way, this line should have been opened on the 10th of May, but at the last moment, the Board of Trade Inspector found the tunnel directly communicating with the Rhondda Valley was not brick-lined throughout, and so condemned it for mineral traffic. The necessary work is now being proceeded with, and by the end of June at any rate, the line should be in full operation. How this will really affect Swansea remains to be seen. It may possibly mean Swansea being inundated by excursionists, for whose advent nobody beyond the publicans will thank the new line, but whether it will bring about that huge increase in coal shipments which so many people have been relying upon, is very problematical

A new dry dock company has been formed in Cardiff under the title of the Cardiff Floating Dock and Ship Repairing Co., Limited, during the past month. The concern takes over the old pontoon, once the property of the now defunct Dumfries Ship Repairing Co., Limited, and we understand that it will be made a commercial dock. There is only one public dry dock in Cardiff, so the advent of the new one will be hailed with delight by shipowners. Whether the course being pursued by the new company is exactly in accord with the prospectus, is an entirely different matter. But the best course possible has been pursued anyhow.

There is some talk of the genial United States Consul at Cardiff being deposed. American Consuls are like the dear gazelle of the poet. You remember the lines, they run something like this:

> "I never had a dear gazelle,
> To glad me with its soft, dark eye,
> But that when it got to know and love me,
> It was sure to die."

No sooner does one get to know and love an American Consul than he dies politically to you, who know, and if not love, at any rate esteem him. Major Jones was in Newcastle when first the writer knew him, and there he was splendidly liked, and there it was that he started his connection with a shipping paper (in 1883) which a well-known Tyneside shipowner tried to push. Of course, whilst Major Jones was on Tyneside, Newcastle was the hub of the universe—next to "Bosting" of course; in Cardiff, the Major took up Cardiff. However, where Major Jones goes we heartily wish him God speed. He has ever been a good American cousin, and in actively helping on the interests of the people amongst whom his government sent him to live, he has set an example which other Consuls might well follow.

The Maritime Mortgage Corporation, Limited, is a concern in which Cardiff is closely concerned. It is a new "easy road to shipowning," and boasts of two Cardiff directors, and one from Bristol. Of course the concern will pay—was there ever a limited company in this world which would not pay its shareholders enormous dividends? but all the same we wish Cardiff had not touched the concern, although its capital is set down at a million sterling.

The Llanelly Harbour Commissioners are considering the desirability of increasing the dock accommodation at their port. It appears that the port may possibly lose the shipment of some 2,000 tons per day of coal unless improved accommodation be provided, and to guard against this the Commissioners are taking the action referred to. That this should be done is very praiseworthy, but it is amusing to find in the course of the discussion of the subject, that these worthy Commissioners "aspire not only to equal Cardiff, but to beat her." It would be as well were Llanelly first to beat Swansea and Newport, and then consider the possibility of excelling the millions of Cardiff.

There has been a considerable increase in the colliers' wages since our last month's notes were written. The report of the sliding-scale audit for the past three months (to 31st March) showed that the wages payable to the workmen of the associated collieries should be 46 per cent. above the standard of 1879, necessitating an advance of 13¾ per cent. from May 1st.

It is perfectly sickening to listen to the twaddle talked by some small seamen about the new line which should do so much good to the port of Orhonada and Swansea Bay. The line should have been opened early in May, but as one of the tunnels was not brick-lined throughout the Board of Trade Inspector refused to pass it. This will delay the opening for some few weeks, but the shares have, nevertheless, advanced to a premium on London buying. A few days since the writer happened to be in the smoking-room of a leading Swansea hotel, and there was edified by one of the local men of light and leading, a County Councillor and harbour trustee reviling the future of this line. Can anyone imagine anything more ridiculous than such a course as this being pursued in a public place for the benefit of any outsiders who may be present? Surely this is not what one would expect from a man possessing even an ordinary amount of business sagacity or *esprit de corps*.

Considerable changes are to be made in connection with the storage of tinplates at Swansea. Hitherto it has been the custom to allow the tinplates free warehouse room until shipped with the natural result that the American buyers have taken an undue advantage of the liberty. This is now to be altered, and warehouse rent will be charged after a month.

The preamble of the Severn Navigation Bill has been passed, and Cardiff naturally feels very satisfied thereat. Should the Bill become law it will naturally have a very beneficial effect upon the great Welsh port.

A week or two since a deputation from Cardiff urged upon Lloyd's Committee the desirability of South Wales being more fully represented on the committee, seeing that only one member is sent by South Wales, the demand is very natural, and it is to be hoped the wishes of the Cardiff people will be granted.

The Cardiff men have also been trying for a Local Marine Board, but Sir Michael Hicks Beach has practically declined to grant this.

Messrs. Tregerthen, Dunn & Co. have recently had a sale of steamship shares, and the reports say the prices obtained in some instances were considered exceptionably good. Seeing that in only one case par, or anything like par, value was obtained for the shares, sarcasm is evidently rampant in Cardiff.

An £125 share (£120 paid) in the St. Donat's Steamship Co. had realised £50; four fully-paid £50 shares inFerncliff Steamship Co. had realised £18 10s. each; six fully-paid £10 shares in Oriental Steamship Co. changes hands at £5 15s., and so on.

BELFAST TRADE NOTES.

THE shipbuilding and engineering trades are fully employed. A number of launches having taken place during the month.

Messrs. Harland & Wolff, Queen's Island shipbuilding yard, launched the s.s. *Plassey*, and handed over to her owners the s.s. *Saint Pancras*, which left here on the 13th May, for Liverpool.

They have now at their finishing berths the s.s. *Imaum*, s.s. *Michigan* and s.s. *Plassey*, the first-named being almost ready for sea.

The Belfast Shipyard, Messrs. Workman, Clark & Co., Limited, had two launches during the past month, the s.s. *City of Dundee*, built to the order of Messrs. S. Smith & Co., the City Line, Glasgow, the other the s.s. *Marlay*, to the order of Messrs. R. Tedcastle & Co., Dublin, for their general trade.

The dispute which occurred during the month with the riveters in this yard is now about settled, the men who went out on strike against a proposed reduction having returned to work pending negotiations.

Messrs. Workman, Clark & Co. will have other launches shortly, and are about to lay down the keel of a new vessel for the Ulster Steamship Co., Limited, Belfast.

Messrs. McIlwaine & Maccoll, Limited, are at present very busy, they launched during the past month the s.s. *Strait Fisher*, to the order of Messrs. Fisher, Barrow-in-Furness, and she is now almost ready for sea. She received her engines, boiler, funnel and masts in the one day, the engines (a fine set of triple-expansion) being put aboard in one lift.

They have received an order for a steel steamer, to carry 400 tons deadweight, for Mr. John Kelly, coal merchant, Queen's Quay, Belfast, to be fitted with triple-expansion engines and all improvements suited to his trade.

They will launch a screw steamer shortly to the order of the Antrim Iron Ore Co.

During the month they had in hand for repairs the s.s. *Dynamic*, Belfast and Liverpool Line, for Board of Trade survey and overhaul, s.s. *Erimus*, s.s. *Balniel*, and have now the s.s. *Topic*.

Messrs. Victor Coates & Co., Limited, have finished the paddle steamers *Erin* and *Bangor Castle*, which have now taken their stations for the season on the Belfast and Bangor route. They had in hand for repairs the s.s. *Ferric*.

The Harbour Commissioners are about to receive tenders for a new ferry boat for the harbour, there being only three at present, and as one of them is almost always laid up for repairs, great inconvenience is felt, particularly at the Prince's and Queen's Quay station, where some hundreds of men have to cross in the meal hours from Messrs. Harland & Wolff's and McIlwaine & Maccoll's works, and the ordering of an additional ferry is certainly a step in the right direction.

The paddle steamer *Cobra*, which carried on a daylight service between Gourock and Belfast during last summer, has been sold by her builders, the Fairfield Co., to the Liverpool, Llandudno and Welsh Coast Steamboat Co., and has been renamed the *St. Ludno*.

The following regarding the new straight channel, Belfast Lough, may possibly interest some of our readers, particularly those who recollect the entrance to Belfast some years ago. The Harbour Commissioners have decided, in marking the new channel, to place along the East or County Down side of the cutting four lighthouses, the outer one of which will be a handsome structure, being hexagonal-shaped, and will be erected on cast-iron piles six in number with a seventh one in the centre, the whole being strongly braced with wrought-iron tension rods. In connection with this lighthouse and adjoining, a structure will be erected on piles for containing the fog-bell and the necessary clockwork driving machinery. The lantern of the lighthouse consists of a sixth order dioptric or repeating arrangement, whereby all the rays of light thrown from the lantern in the desired direction will be repacted and sent out into space as parallel beams of light. The light will be a clear white, being visible about seven miles, and situated about 40 feet above low-water level, and, for the purpose of indicating the proper location of the lighthouse, an eclipsing apparatus occulting the light every twelve seconds by means of two short and one long screen will be fixed to revolve around the lantern inside the light-room. These three occulting screens in motion, driven by clockwork machinery, will represent the letter U of the Morse alphabet, *viz.*, two dots and one dash. It is the invention and patent of Sir William Thomson. The three intermediate lighthouses are to be placed at equal distances between the East Twin Island light and the outer house above referred to. The opposite or West side of the channel will be marked with five large black buoys.

The Harbour Commissioners have advertised portions of the property to let on leases of 31 years, the situation on the side of the river being well adapted for shipbuilding or engineering purposes.

A patent has been granted to Mr. James Maxton, Lloyd's surveyor, Belfast, for improvements in submerged buoyant bridges or passages.

Belfast is about to be connected by telephone with Dublin, a distance of 113 miles, and such accommodation will doubtless be largely availed of.

During the month the Belfast branches of the Amalgamated Society of Engineers held a most successful concert, soirée, and ball in the Ulster Hall, Belfast. The chair was occupied by C. C. Connor, Esq., J.P., Mayor of Belfast; and amongst those present were Sir James H. Haslett, J. P., J. H. McIlwaine and H. Maccoll (of McIlwaine & Maccoll, engineers and shipbuilders), Edward Seddall, D.I.R.I.C., &c., and apologies for absence were received from Sir E. J. Harland, Bart., M.P., Thomas Sexton, M.P., Victor Coates, J.P., G. W. Wolff, F. Workman, &c., &c.

The fine Clyde saloon paddle steamer *Victoria*, chartered by Mr. Thomas Neigh, Jun., has taken her place on the Belfast and Bangor route, and a sister ship is also expected. This opposition to the old company was, we must say, badly wanted, for the two steamers *Erin* and *Bangor Castle* would not stand comparison with any of the floating palaces plying on the Firth of Clyde as regards speed or appearance, and the great number of passengers patronising the *Victoria* promises a good season for her charterer.

The new day-light service steamer the *Adder*, built by the Fairfield Co., will take her station on the Belfast and Prince's pier, Greenock route, on the 14th June, which, considering the splendid weather we have had here of late, is rather behind time.

LEITH NOTES.

IN general, trade here has had a quiet turn this month. In the docks, with the exception of one or two large arrivals of grain and nitrate of soda, things are at a standstill. The engineering and shipbuilding trades are now suffering from depression, partially relieved by the large number of repair orders which have come to the front. Only one new order has been placed in Leith this month, Messrs. Ramage & Ferguson being fortunate enough to secure an order from the Royal Mail Steamship Co., for a steel screw tender 177 feet long, to be supplied by them, with engines to 800 I.H.P. She will be employed on the Antigua coast, and will attain a speed of 12½ knots. The above firm received notice on the 17th ult., of the arrival at Port Said of the s.s. *Heung Shan* recently built by them, the time taken from Dover being 9 days 22 hours net steaming, giving a mean speed of about 14½ knots. Considering that she is built for river service, and is therefore of light draught, with a great surface of deck-houses, her performance reflects great credit on the builders.

On the 3rd ult. the steel screw steamer *Managua*, launched by the Grangemouth Dockyard Co., went her official trial trip, when a mean speed of 11½ knots was attained.

On the 14th ult. the steel steamer *Simon Dumois*, also launched by the Grangemouth Dockyard Co., went her trial trip, a speed of 12 knots being attained on the measured mile.

This enterprising firm are still very busy, having at present four or five steamers fitting out at their wharf, while they have still several orders to lay down.

Messrs. S. & H. Morton & Co., Leith, have three steamers building, and a large number of repair orders going on.

Messrs. Cran & Co., Albert Engine Works, are also fortunate in having a number of repair orders to keep them busy.

In Messrs. Hawthorns & Co.'s yard a steel screw trawler is nearing completion, but as yet there is no word of anything going down in her place.

On the 6th ult. Messrs. Mackenzie & Co., Sandport Dock, launched a small wooden vessel called the *Alert*, to be engined by Messrs. Hawthorns & Co. She is built to the order of the Union Boating Co., of Port Elizabeth, and is intended for the same trade as the *Colonist*, built and engined by the same firms last summer.

In the freight market, boats are very numerous, and owners are doing their best to avoid a lay up, which must inevitably be the result of such a large amount of new tonnage recently launched.

The coal trade is looking a little brisker, and the outputs should compare favourably with those of the corresponding month last year.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Ellen M'Gregor.—On April 19th Messrs. Cochrane, Cooper & Schofield launched from their shipyard at Grovehill, Beverley, a steam trawler, built for Messrs. Pickering, Haldane & Co., of Hull. She was named the *Ellen M'Gregor*, and is of the following dimensions:—100 ft. long, 20 ft. 6 in. beam, and 11 ft. depth of hold. She is classed 100 A 1 at Lloyd's, and will be fitted with 50 H.P. triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull.

Prodano.—On April 21st a screw steamer was launched from the building yard of the Blyth Shipbuilding Co., Limited, at Blyth. The vessel has been built for the Pinkney & Sons Steamship Co., Limited, of Sunderland. Her leading dimensions are as follows:—Length, 326 ft.; breadth, 40 ft.; and depth, 27 ft. 9 in. The vessel is built principally of steel. The engines are being made by the North-Eastern Engineering Co., Limited, of Sunderland; and she is fitted with patent windlass by Emerson, Walker & Co. The vessel was named the *Prodano* by Miss Pinkney, of Sunderland.

Constantinos Stathatos.—On April 22nd there was launched from the yard of Messrs. J. Readhead & Sons, West Docks, South Shields, a new screw steamer of the following dimensions:—Length, 299 ft.; breadth, 39 ft. 6 in.; depth, moulded, 26 ft. 6 in. She is of the improved well-deck type, having poop, long raised quarter-deck, bridge amidships, and topgallant forecastle. Her class is 100 A 1 at Lloyd's, special survey, and she is fitted with shifting boards and bulkheads in compliance with the Grain Cargoes Act. The engines, which have also been built by Messrs. J. Readhead & Sons, are of the triple-expansion type, with cylinders of 23 in., 37½ in., and 61½ in., and 39 in. stroke. Steam is supplied from two large steel boilers at a pressure of 160 lbs. to the square inch. The vessel has been built to the order of Messrs. Stathatos Brothers, of Ibrail and Sulina, and is the fifth steamer turned out by the same builders for this firm. On leaving the way she was christened the *Constantinos Stathatos* by Miss Varnakiottes, of South Shields.

Composite Lightship.—On April 22nd Messrs. R. & H. Green launched at Blackwall the first of two composite lightships which they are constructing for the Hon. Corporation of Trinity House. These vessels are built from designs prepared by Mr. F. C. Goodall, surveyor of shipping to the Trinity House, and their construction presents some novel features. Each is on the composite principle, and is metal-fastened throughout. All the ironwork is coated with soapstone paint, a composition which is now largely employed in iron and steel ships for preventing oxidation, and the bottom has been covered with bitumastic cement, which is lighter and more elastic than any other cement in use for marine purposes. In each lightship there is a large windlass of great power, driven by compressed air, which is supplied and stored by a caloric engine placed in the hold. The first of the two is intended for service at North Haisboro'.

Wharfe.—On April 23rd Messrs. William Dobson & Co. launched from their shipbuilding yard at Low Walker a screw steamer, which they have built to the order of the Goole Steam Shipping Co., Limited, of Goole, for their service between Goole and Rotterdam. The vessel was named *Wharfe*. She was afterwards taken to the Wallsend Slipway and Engineering Co.'s works to receive her machinery.

Kong Inge.—On April 30th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., at Bill Quay-on-Tyne, the first of two steel screw steamers, built to the order of Captain Dannevig, R.N., for the Sondenfjeids-Norske Dampskibsselskab, of Christiania. The vessel is of the awning deck type, and has been designed for the purpose of carrying passengers and light general cargo between Christiania and Hamburg, and is built to the highest class of Norwegian Veritas. The principal dimensions are:—Length, 178 ft.; beam, 27 ft. 6 in.; depth, moulded (to awning deck), 20 ft. 6 in. Ample saloon and state rooms for first-class passengers are fitted up in 'tween decks amidships, having entrance from deck-house forward of casing on awning deck, where chart-room and smoke-room are also arranged. Engineers and officers' accommodation is in 'tween decks abaft engine-room, and the sailors and firemen are berthed forward. The vessel will have water ballast in fore and after peaks, and in deep tank in after hold. Steam cranes are fitted on deck for despatch in loading and discharging cargo. The engines have been built to Norwegian Veritas requirements by the North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne. They are on the triple-expansion principle, and have cylinders 15¼ in., 25 in., and 41 in. with 27 in. stroke, capable of propelling the vessel at a speed of 11 knots loaded. On leaving the ways the vessel was christened the *Kong Inge* by Mrs. L. M. Bodin, of Sunderland.

Sestao.—On May 3rd Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz:—Length, over all, 255 ft.; breadth, 35 ft. 6 in.; depth, 18 ft. 10 in.; built to class 100 A1 at Lloyd's. She is of the well-decked type, and is to the order of Ramon de la Sota, Esq., of Bilbao. She has a long raised quarter-deck, long bridge and topgallant forecastle. The hull is built on the web-frame principle. Large hatchways are fitted, four steam winches, direct steam windlass by Emerson, Walker & Co., steam steering gear amidships, and screw gear aft, large donkey boiler, and cellular double bottom throughout. Handsome accommodation for the captain and officers will be fitted aft. The boats will be carried on beams overhead, and all modern appliances fitted. First-class engines on the three-cylinder triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. The cylinders are 20 in., 31½ in., and 53 in. diameter, with a piston stroke of 36 in., and a constant supply of steam at a working pressure of 100 lbs. per square inch will be maintained by two fine steel boilers. She was gracefully christened *Sestao* by Miss Mabel Dickinson, of Newcastle-on-Tyne, wishing "Buena Suerte al *Sestao*."

Bendo.—On May 3rd Messrs. Schlesinger, Davis & Co. launched from their shipbuilding yard, Wallsend-on-Tyne, a steel screw steamer of the following dimensions:—Length, between perpendiculars, 345 ft.; breadth, moulded, 42 ft. 11 in.; depth, moulded, 24 ft. 1 in. This vessel is a sister ship to the *Bendi*, launched from the same yard a few weeks since, and is also built for Mr. Joseph Hoult, of Liverpool, the owner of the *Bendi* and other vessels of the Ben Line lately built by Messrs. Schlesinger, Davis & Co. The *Bendo* has a deadweight carrying capacity of about 5,100 tons. She is constructed on the cellular bottom principle throughout for water ballast, and has a poop, long raised quarter-deck, long bridge extending beyond foremast, and a topgallant forecastle. Shifting boards and trimming hatches will be fitted to each hold in order to comply with the Grain Cargoes Act. She will be rigged as a two-masted fore-and-aft schooner. Maginnis's patent steering gear will be fitted in the engine-room, with shafting running along the deck, acting direct on the quadrant, thus dispensing with all chains, rods, sheaves, &c. Patent steam windlass will be fitted on the forecastle. The vessel will also be fitted with five powerful steam winches for the rapid loading and discharging of cargo, special arrangements being made on deck for the storing of all cargo gear. The accommodation for the captain, officers, and engineers is amidships in houses on the top of the bridge deck, the forecastle being fitted up in a substantial manner for the crew. The *Bendo* classes 100 A1 steel at Lloyd's, and has been built under special survey. The engines, of the triple-expansion description, are of about 1,500 I.H.P., having cylinders 25 in., 42 in., and 64 in. by 45 in. length of stroke. The boilers are of steel, two in number, working at a pressure of 160 lbs. per square inch. The machinery has been constructed by the North-Eastern Marine Engineering Co., Wallsend-on-Tyne, and together with the hull has been erected under the superintendence of Mr. A. C. Hay, of Liverpool, the owner's superintendent. The vessel was named the *Bendo* by Mrs. Davis.

Cookham.—On May 3rd there was successfully launched from the Shipbuilding, Engineering, and Repairing Works of Messrs. T. R. Oswald & Co., Limited, a steel screw cargo steamer, built for Messrs. Lambert Bros., of the following dimensions:—Length, extreme, 261 ft.; breadth, extreme, 32 ft. 6 in.; depth, extreme, 21 ft.; gross tonnage about 1,450; net tonnage about 950; carrying a deadweight cargo of 2,400. The vessel is built on the web-frame principle, with single deck, water ballast in double bottom all fore and aft, and in after peak, has long poop extending over engine and boiler space, short topgallant forecastle for the berthing of the crew, three extra large hatchways, with four powerful steam winches for the rapid working of cargo, hand windlass on forecastle, arranged to be worked by steam winch, Higginson's steam quarter-master (hand and steam combined) amidships, powerful screw steering gear aft. Accommodation is provided for the captain and officers in the poop, and for engineers at the side of engine casing amidships. She is handsomely rigged as a schooner with three pole-masts. The engines are of the triple-expansion type, having cylinders 19½ in., 29 in., and 55 in., with a stroke of 36 in. Steam is supplied by two extra large steel boilers, working at a pressure of 160 lbs. per square inch. Steam is supplied to the winches by a vertical boiler, which, as also the winches and windlass, are by Clarke, Chapman & Co. As the vessel left the ways she was gracefully named *Cookham* by Miss Ella Oswald.

Norna.—On Saturday, May 3rd, Messrs. Edward Withy & Co. launched from their yard at Hartlepool, a large steel screw steamer, built to the order of Messrs. Herskind & Woods, of West Hartlepool. She is a fine type of a modern cargo boat, measuring over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge house, and topgallant forecastle. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. In the main and after holds the vessel is built on the web-frame system, which gives great strength and dispenses with all hold beams, thereby enabling the ship to carry cargoes of the bulkiest description. The cellular bottom is fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft lengths, making the structure of the ship very strong. Four steam winches, donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin, providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels, executed in a very elegant and effective style by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, and has been constructed under the personal supervision of Captain Petersen. She will be fitted with triple-expansion engines by Messrs. W. Gray & Co., Limited, Central Marine Engine Works, West Hartlepool, and built under the superintendence of Mr. J. R. Fothergill. On leaving the ways the vessel was gracefully christened *Norna* by Mrs. J. J. Woods.

Clara.—On May 3rd the screw steamer *Clara* was successfully launched from the yard of Messrs. John Blumer & Co., North Dock, Sunderland. The vessel is built to the order of Messrs. Robinson Brothers, Whitby. Length, b.p., 270 ft.; beam, 37 ft.; and 19 ft. 4 in. depth, moulded. The vessel was towed over to the works of the North-Eastern Engineering Co., South Dock, to receive her engines.

Reaumur.—On May 5th this vessel was successfully launched from the yard of Messrs. Wm. Doxford & Sons, at Pallion. She has been built to the order of Messrs. A. d'Orbigny & Faustin Fils, of La Rochelle, France; is entirely of steel, and built to Lloyd's A1 class. The principal dimensions are:—Length, between perpendiculars, 250 ft.; breadth, extreme, 35 ft.; depth, moulded, 18 ft. 6 in.; with cellular bottom fore and aft. The engines are triple-expansion, three cranks, by Messrs. Doxford with all the latest improvements, the cylinders being 21 in., 33 in., 54 in. by 36 in. stroke, and they are supplied with high pressure steam from very large boilers. She is fitted with Bow McLachlan's patent steam steering gear, screw gear aft by Crawford Bros., of Monkwearmouth, and 4·6 in. by 10 in. steam winches by Welford Bros., of Pallion, with all the latest improvements for cargo purposes. During construction the vessel has been superintended by Captain Plisson, the engines and boilers being looked after by Monsr. Lesansse, the engineer to the company. The christening ceremony was gracefully performed by Miss Holme, of London. Messrs. Doxford are also now building a sister ship to be named the *Valin*, which will be launched on the 31st ult., and will make a fleet of 14 vessels of about 25,000 tons owned by Messrs. A. d'Orbigny & Faustin Fils. This is an exceptionally large fleet for the port of La Rochelle compared with its two neighbouring ports, Nantes and Bordeaux, which it has left far behind. This maritime development is due greatly to the courage and energy which the said owners have shown in all their enterprises, and shows that they have known how to develop the commercial importance of their city.

Hokkai Maru.—On May 5th there was launched from Messrs. Craig, Taylor & Co.'s Thornaby shipbuilding yard, Stockton-on-Tees, a handsome awning-decked vessel, built to the order of Messrs. Pile & Co., London, for the Japan Mail Steamship Co., and to be engaged in the Japanese coasting passenger trade. The vessel is of the following dimensions, viz., 177 ft. by 26 ft 6 in. by 20 ft. 6 in. depth, moulded to awning-deck. She is fitted up with large teak deck-house aft, steam winches, patent windlass by Emerson, Walker & Co., and all modern improvements; water ballast in the peaks and after holds. Triple-expansion engines, made by Messrs. Hanna, Donald & Wilson, of Paisley, of the following sizes, are being supplied, viz., 13 in., 21 in., and 34 in. by 24 in. stroke; large steel boiler, 160 lbs. pressure. As she entered the water she was gracefully christened *Hokkai Maru* by Mrs. George Ordish, of Norton, sister of the junior partner.

Necochea.—On May 5th there was launched at the Elswick Shipyard an armed cruiser named the *Necochea*, built by the Elswick firm for the Argentine Government. She is a protected cruiser, but without vertical side armour. With a displacement of 3,200 tons, her engines are 13,500 I.H.P., equal to a speed of over 22 knots, or 26 miles an hour.

Knight Commander.—On May 6th there was launched from the shipbuilding yard of the Palmer Co., at Jarrow, a large steel screw steamer, of the following dimensions:—Length between perpendiculars, 400 ft.; breadth, moulded, 47 ft.; depth, 30 ft. 7½ in. The ship has been built far in excess of Lloyd's 100 A1 class. She is of the three-decked type, the upper deck being sheathed with pine. A large bridge amidships, extending over the engine-room and boiler space, will contain accommodation for the captain, officers, and engineers, while the petty officers, crew and firemen are accommodated in the poop aft. The vessel has a set of water-tight steel compartments and shifting boards for grain and other shifting cargoes. Water ballast is provided in cellular bottoms, and also in the deep tank. Emerson & Walker's direct steam double capstan windlass is fitted up forward, Harrison's steam steering gear amidships, and screw gear aft. The vessel has been built to the order of Greenshields, Cowie & Co., of the Knight Line, Liverpool, and will have all the latest improvements, including the electric light, throughout. She is designed to carry about 7,000 tons deadweight As the vessel left the ways she was christened the *Knight Commander* by Mrs. Green Corbridge.

Nethergate.—On May 6th a new screw steamer was launched from the premises of Messrs. T. Turnbull & Son, Whitehall, Whitby. The dimensions of the new vessel are:—Length over all, 298 ft. 9 in.; length between perpendiculars, 288 ft.; breadth, 38 ft. 2 in.; depth to top of floor-plate, 19 ft. 9 in. Her engines are by Messrs. Blair & Co., Stockton-on-Tees, and are of 175 N.H.P.; and she has Emerson, Walker & Co.'s patent windlass on forecastle. She was christened the *Nethergate*. The vessel has been built to the order of Messrs. Turnbull, Scott & Co., of London.

Paddle Steamer.—On May 7th Messrs. R. & H. Green launched from their shipbuilding yard at Blackwall the first of two paddle passenger steamers, building by them for the Bosphorus Steam Navigation Co., whose large fleet of steamers work the passenger traffic between Constantinople and the Bosphorus ports. This vessel, 165 ft. by 21 ft. by 10 ft., is built entirely of steel, and will be fitted with compound oscillating paddle engines by Messrs. J. Penn & Sons, Limited, Greenwich.

Atacama.—On May 7th Messrs. R. & J. Evans & Co. launched from their yard at the Brunswick Dock, Liverpool, an iron barque of about 1,100 tons register, named the *Atacama*, to the order of Messrs. Samuel Wakeham & Son, of Liverpool.

Rosales.—On May 7th Messrs. Laird Brothers launched from their works at Birkenhead the second of the two torpedo gunboats they have built for the Government of the Argentine Confederation. The vessel was christened the *Rosales*. Her tonnage is 615 tons o.m., and her machinery is intended to develop 3,250 I.H.P. collectively.

Conqueror.—On May 7th an iron paddle steamer was launched from the yard of Messrs. Hepple and Co., North Shields, intended for service between England and near Continental ports. The vessel, whose dimensions are 140 ft. by 22 ft. by 12 ft., and whose engines are made to propel her at a speed of 12 knots, has been built to the order of Sandford and Sons, Gravesend. She was named *Conqueror* by Miss Connie Hepple, youngest daughter of the builder.

Hollsinide.—On May 8th the steel screw steamer *Hollinside*, built to the order of Messrs. Charlton, M'Allum & Co., Newcastle, was launched by the Edwards' Shipbuilding Co., Limited, from their yard at Howdon. The dimensions are:—Length, 225 ft.; breadth, 31 ft. 6 in.; depth, 16 ft. Messrs George Clark, Limited, Sunderland, are supplying engines of 130 N.H.P.

Aloedene.—On May 8th Messrs. Short Brothers launched from their yard at Pallion a steel screw steamer of the following dimensions:—Length, between perpendiculars, 290 ft.; breadth, extreme, 39 ft. 10 in.; and 22 ft. 3 in. depth, moulded. She is built throughout of Siemens-Martin steel, to the highest class in Lloyd's registry. Triple-expansion engines are to be fitted of about 1,160 I.H.P., having cylinders of 22 in., 36 in., 59 in. diameter, and 39 in. stroke. The machinery has been constructed by Messrs. George Clark, Limited; and she is fitted with Emerson, Walker & Co.'s patent windlass. The vessel was named *Aloedene*.

Marian.—On May 8th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, a finely modelled steel screw steamer, built on the three-deck grade, with poop, long bridge-house amidships and topgallant forecastle, cellular bottom throughout, classed 100 A1 at Lloyd's, and built under special survey, engines by the North-Eastern Marine Engineering Co., Wallsend, of 1,800 I.H.P. The vessel was named the *Marian* by Mrs. F. J. Trewent, of Tynemouth.

Asloun.—On May 9th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, the seventh steamer built by that firm for Messrs. Adam Bros., of Aberdeen, London and Newcastle. The length of the vessel is 309 ft. between perpendiculars; breadth, 41 ft., and depth of hold 27 ft. 6 in. The steamer is built to the spar deck rule and has large topgallant forecastle to accommodate crew and firemen, and full poop aft, under which is placed the saloon and accommodation for captain, officers, and a few first-class passengers. The engineers are berthed in deck-house abaft the engine-room. The vessel is constructed upon the web-frame principle, thus dispensing with hold beams, and has cellular water ballast all fore and aft, all weather decks are of wood and all frames of Z steel, her class will be 100 A1 at Lloyd's, special survey. The deck machinery consists of four large steam winches and steam steering gear, Emerson & Walker's patent windlass, Tyzack's patent anchors, and all the usual appliances for handling cargo and working the ship with the greatest possible despatch. The main engines are upon the tri-compound principle by Messrs. Black, Hawthorn & Co., Gateshead, and have cylinders 23½ in., 39 in., and 64 in. by 42 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch. The vessel during construction has been inspected on behalf of the owners by Mr. Nicol, and upon leaving the ways was gracefully named *Asloun* by Mrs. Meharry, wife of the Rev. J. B. Meharry, minister Crouch-end Church, London, after which she proceeded to the Tyne to receive her machinery.

Grand Duke Alexis.—On May 9th there was launched from the shipbuilding yard of Messrs. R. & W. Hawthorn, Leslie & Co., Limited, Hebburn, a new steamer, built to the order of the Russian Steam Navigation & Trading Co. The dimensions of the vessel are as follows:—Length, 300 ft.; breadth, 37 ft.; depth, 26 ft. She has been built to class 100 A1 at Lloyd's. The engines and boilers are from the St. Peter's Works of the same firm. The vessel was named the *Grand Duke Alexis*.

Julia.—On May 17th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel screw steamer built to the order of Th. Rodenacker, Esq., of Danzig, of the following dimensions:—Length, 228 ft.; breadth, 34 ft. 6 in.; depth, moulded, 21 ft. 6 in. The vessel has been built under special survey, and to Lloyd's 100 A1 class, on the spar deck grade, with bridge house amidships, under which the saloon, captain's room, spare state rooms, and officers will be quartered. Water ballast in a cellular double bottom, all fore and aft, also in the fore-and-aft peaks. Improved steam winches for the rapid stowage and discharge of cargo, steam steering gear, and other appliances of the latest design will form part of the vessel's equipment. Engines, of the triple-expansion type, have been built by Messrs. Black, Hawthorne & Co., Gateshead, and are capable of indicating 750 H.P. The hull and engines have been built under the superintendence of Captain Gustav Schmidt, of Danzig, and this is the eighth vessel built for the same owners. On leaving the ways the vessel was named the *Julia* by Mrs. A. Claughton, of North Shields.

India.—On May 17th Messrs. Cochrane, Cooper & Schofield, of Grovehill, Beverley, launched a steam trawler, built for the Hull Steam Fishing and Ice Co. The trawler, which was named the *India*, is of the following dimensions:—Length, 105 ft.; breadth, 21 ft.; depth, 11 ft. Her engines will be supplied by Messrs. C. D. Holmes & Co., of Hull.

Taff.—On May 17th Messrs. Osbourne, Graham & Co. launched a steel screw steamer, built to the order of the Cardiff Steamship Co., Limited, of which Messrs. Hooper, Campbell & Co. are managers. The vessel is for their line of steamers trading between Cardiff and Bordeaux, and is 200 ft. long by 29 ft. 3 in. by 15 ft. 3 in. deep, built with long full poop, open topgallant-forecastle, water ballast, web frames, and will be fitted with tri-compound engines by the North-Eastern Marine Engineering Co., Limited, Sunderland; and she is fitted with Emerson, Walker's patent windlass. The vessel was named the *Taff* by Mrs. Campbell, wife of one of the managing owners.

Inverness.—On May 17th Messrs. Ropner & Son launched from their shipyard at Stockton a steel steamer, built to the order of Messrs. G. R. Sanderson & Co., of Hull, her dimensions being as follows, viz.:—Length over all, 282 ft. 6 in.; breadth, 38 ft. 10 in.; and depth, moulded, 21 ft. 11 in. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 900 I.H.P., and two large steel boilers working at 160 lbs. She was christened the *Inverness*.

Tafna.—On May 17th Messrs. Wigham, Richardson & Co. launched from there Neptune Shipyard a finely modelled steel screw steamer, designed for a service speed of 13 knots, and built to the order of the Compagnie Anonyme de Navigation Mixte, of Marseilles, being the sixth steamer built for that company by Messrs. Wigham, Richardson & Co. She is 260 ft. long, 32 ft. beam, and 25 ft. deep, and is fitted up with accommodation of a most elegant description for first, second, and third-class passengers in the service between Marseilles and Algiers, for which she is destined. The engines are on the triple-expansion principle, and are also being supplied by Messrs. Wigham, Richardson & Co. As the vessel left the ways she was named the *Tafna*, the christening ceremony being performed by Miss Barry, daughter of Monsieur L. Barry, French Consul at Newcastle.

Glen Caladh Tower.—On May 17th Messrs. Robert Stephenson & Co., Limited, launched from their shipyard at Hebburn a large spar-deck screw steamer, of the following dimensions:—Length, 351 ft.; breadth, 41¼ ft.; depth, 29 ft. She has been built for Messrs. F. Stumore & Co., of London. The engines, which are of the triple-expansion type, are of 1,800 I.H.P. The steamer was named the *Glen Caladh Tower*.

Darlington.—On May 19th Messrs. Richardson, Duck & Co. launched, from their yard at South Stockton, a steel screw steamer of the following dimensions, viz.:—Length over all, 307 ft. 4 in.; breadth, extreme, 40 ft.; depth of hold, 20 ft. 2 in. The vessel, which has been built to the order of the Commercial Steamship Co., Limited, of London, has a half poop aft, with accommodation for captain, officers, and passengers, a raised quarter deck, and a long bridge from after engine-room bulkhead to stem. The engineers are berthed in a deckhouse, on quarter deck, and the crew is 'tween decks, alongside fore hatch. She is built to the highest class at Lloyd's, and has a double bottom all fore and aft on the cellular principle, capable of containing about 560 tons of water ballast. She is fitted with an Emerson Walker's patent steam windlass, has a large Cestus donkey boiler, four horizontal steam winches, and every modern improvement for the loading and discharging of cargo. The engines, by Messrs. Blair & Co., Limited, of Stockton, have cylinders 22½ in., 37 in., and 61 in. by 42 in. stroke. As the vessel was leaving the ways she was christened *Darlington* by Miss Gibb, of Blyth.

Queensland.—On May 19th Messrs. Joseph L. Thompson & Son launched from their North Sands Shipyard the steel screw steamer *Queensland*. She is 375 ft. in length, 48 ft. beam, and 27 ft. 3 in. depth, and of 8,100 tons displacement, and has been built to the order of Mr. William Kish, of Snnderland. The engines are of the triple-expansion type, and are being fitted by Mr. John Dickinson, of Palmer's Hill Engine Works.

Lyell.—On May 19th Messrs. Bartram, Haswell & Co. launched from their shipbuilding yard at South Dock, Snnderland, a steel screw steamer named the *Lyell*, built for Messrs. Wilkie & Turnbull. The following are the principal dimensions:—Length, 300 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 7½ in.; gross tonnage, 2,460 tons. The engines are by Mr. John Dickinson, and are of 1,150 I.H.P.

Mendelssohn.—On Tuesday, May 20th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Qnay-on-Tyne, a steel screw steamer which has been built to the order of Messrs. Jenneson, Taylor & Co., of Sunderland. She is of the following dimensions, viz.—Length, 300 ft.; breadth, 41 ft.; depth, 22 ft. 2 in.; and is built under Lloyd's special survey to class 100 A1 on the partial awning deck rule. This steamer has water ballast right fore and aft, on the cellular system, and is fitted with all modern improvements for the rapid loading and discharging of cargo, including large donkey boiler working at 160lbs. pressure, and five double cylindered steam winches and has direct acting steam windlass, steam steering gear by Messrs. John Lynn & Co., Sunderland. Hastie's screw gear aft, and Nisbet's improved boats' detaching gear in accordance with the new regulations of the Board of Trade. The engines, which are to be supplied by Messrs. Wallsend Slipway & Engineering Co., Limited, are of the triple-expansion type, having cylinders 23 in., 38in. and 61 in. by 42 in. stroke, with two large boilers working at 160 lbs. pressure. On leaving the ways the vessel was gracefully named the *Mendelssohn* by Mrs. James Thompson, of Sunderland.

Salado.—On Tuesday, May 20th, Messrs. Raylton, Dixon & Co. launched from their Cleveland dockyard, Middlesbro', a steel screw steamer for Messrs. Arthur Holland & Co., London. She is built on the web-frame principle, having poop, raised quarter-deck, long bridge, topgallant forecastle, and fitted as a first-class cargo boat throughout. Her dimensions are:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a deadweight capacity of about 3,300 tons. Her engines will be supplied by the North-Eastern Marine Engineering Co., Limited, Sunderland, on the triple-expansion principle, having cylinders 21 in., 35 in. and 57 in. by 39 in. stroke; and she is fitted with Emerson, Walker & Co.'s patent direct acting windlass. On leaving the ways the vessel was christened *Salado*. This is the fourth vessel launched by Messrs. Raylton, Dixon & Co. for this firm within the last two months.

Avonmouth and Dartmouth.—On May 20th there were launched from the shipbuilding yard of Messrs. W. Harkess & Son, Middlesbro', two iron steam trawlers, built to the order of the Western Steam Trawling Co., of Bristol, for their Milford Haven fishing fleet. The dimensions are:—Length, 100 ft.; breadth, 20 ft; depth, 12 ft.; and they are fitted throughout with the very latest improvements for the present day fishing trade requirements, having raised quarter-decks, large and airy fish holds, patent trawl ports, dandy scores, powerful steam trawling winches, patent windlasses and steering gears. The engines are compound direct acting, 45 N.H.P. On leaving the ways they were named *Avonmouth* and *Dartmouth* by Miss Livingstone and Mrs. Head, of Middlesbro'.

Arab.—On May 20th there was launched from Messrs. Palmer & Co.'s Jarrow yard a screw steamer of the following dimensions:—Length, between perpendiculars, 375 ft.; breadth, moulded, 46 ft.; depth, moulded, 31 ft. 3 in. The vessel, which is built to class 100 A1 at Lloyd's, is of the spar-deck type. Accommodation for the engineers and officers is provided in a bridge amidships, and the crew are berthed in the forecastle. The spar and main decks are of steel throughout, the former being sheeted with pine. A cellular bottom for water ballast is fitted fore and aft. The vessel will be fitted with all the latest improvements for the rapid loading and discharging of cargo, and will be lighted throughout with electricity.

Trevaylor.—On May 20th there was launched from the shipbuilding yard of Messrs. John Readhead & Son, West Dock, South Shields, a steel screw steamer, named *Trevaylor*, which has been built to the order of Messrs. E. Hain & Son, St. Ives. The following are the dimensions of the vessel:—Length, 290 ft.; breadth, 40 ft.; depth, 21 ft. She is of the improved well-deck type, classed 100 A1 at Lloyd's under special survey, and fitted with bulkheads and shifting boards, in compliance with the Grain Cargoes Act. The triple-expansion engines, also built by Messrs. Readhead & Sons, have cylinders of 23 in., 37½ in., and 61½ in. diameter, and a piston stroke of 39 in. Steam will be supplied by two steam boilers, at a pressure of 160 lbs. to the square inch. The *Trevaylor* is the twenty-first steamer built by Messrs. Readhead & Sons for the same owners.

Malvern.—On May 22nd Messrs. W. Gray & Co., Limited, West Hartlepool, launched a fine steel screw steamer, which has been built to the order of Messrs. Galbraith, Pembroke & Co., London. The dimensions of the vessel are: Length, over all, 310 ft.; breadth, 38 ft. 6 in.; depth, 23 ft. 3 in. She will take Lloyd's highest class and carry over 3,800 tons deadweight. She is constructed on the web-frame principle, with double bottom under each hold for water ballast, and has poop, raised quarter-deck, long bridge and topgallant forecastle. The principal accommodation, including saloon, &c., is aft in the poop, while that for the engineers is close to the engine-room, and the crew's berths are in the fore part of the bridge. She is fitted with two donkey boilers, patent steam steering gear amidships, patent screw gear aft, patent direct steam windlass, powerful steam winches, and all the latest improvements for a first-class cargo steamer. She will shortly go under the large sheerlegs at the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, to receive her machinery, consisting of fine triple-expansion engines and two large steel boilers. The ceremony of christening the steamer *Malvern* was gracefully performed by Mrs. G. H. Baines, of West Hartlepool, daughter of Sir William Gray. The vessel and her machinery are being superintended by Captain Page and Mr. T. O. Charteis respectively on behalf of the owners.

LAUNCHES—Scotch.

Wodonga.—On April 22nd Messrs. A. & J. Inglis launched from their shipbuilding yard at Partick the *Wodonga*, a steel screw steamer of about 2,400 tons gross, built to the order of the Australasian United Steam Navigation Co., Limited, London, for their Australian trade. Her dimensions are—Length, 310 ft.; breadth, 39 ft.; depth, 25 ft. The vessel has been fitted up to accommodate 130 first-class and 100 second-class passengers. There will be an extensive installation of electric light on board. She will be fitted by the builders with triple-expansion engines to indicate 3,000 H.P., and her machinery for the rapid and noiseless discharging of cargo will be of the most modern type.

Andromeda.—On April 23rd Messrs. R. Duncan & Co., Port-Glasgow, launched a four-masted steel sailing ship, named *Andromeda*, of 1,900 tons register, to carry 3,200 tons deadweight cargo. Dimensions:—Length, 260 ft.; width, 40 ft.; depth, 25 ft, moulded. This vessel is built to Lloyd's highest class to the order of Mr. George F. Smith, of St. John, New Brnnswick, and is the second built for the same owners by Messrs. Robert Duncan & Co. The construction of the vessel was superintended by Captain Andrews, who will also command her. After the launch the vessel was towed into Port-Glasgow Harbour to fit out. She is chartered by Messrs. Guthrie, M'Donald, Hood & Co., Glasgow, to load pipes at Grecnock for Rio.

Zambesi.—On April 23rd the Grangemonth Dockyard Co. launched from their shipbuilding yard at Grangemonth a handsomely modelled steel barquentine, named *Zambesi*, and built to the order of Messrs. Fabre & Fils, of Marseilles, for their trade to Mozambiqne. Dimensions—140 ft. by 27 ft. by 13 ft. 9 in.; deadweight, about 600 tons. She has been built to the highest class at Lloyd's and under their special survey. Captain Sauren has superintended her construction on behalf of the owners.

Lord Bangor.—On April 25th Messrs. Russel & Co., shipbuilders, Greenock, launched a large steel spar-decked screw steamer of the following dimensions:—Length, 320 ft.; breadth, 42 ft. 6 in.; and depth, 27 ft. 7 in., with a deadweight carrying capacity of 4,500 tons; and she is fitted with patent capstan windlass by Emerson, Walker & Co. The vessel was named *Lord Bangor*, and is owned by the Lord Line, managed by Messrs. Dixon & Sons, Belfast.

Tortugu.—On April 25th Messrs. Blackwood & Gordon, Port-Glasgow, launched a steel schooner named *Tortugu*, for Messrs. James & Alexander Allan, of Glasgow, for their River Plate coasting trade.

Talbot.—On April 30th Messrs. S. M'Knight & Co., shipbuilders, Ayr, launched from their yard a steel screw steamer, built under special survey to class 100 A1 in Lloyd's Registry, to the order of John Bacon, Limited, Liverpool, for their general carrying trade between Liverpool, Swansea, and Port-Talbot. Dimensions:—Length, between perpendiculars, 180 ft.; breadth, 27·6 ft.; depth of hold to main deck, 13·6 ft.; about 550 tons gross measurement. The engines are triple-expansion, and will be supplied by Muir & Couston, Kinning Park, Glasgow. The steamer was named the *Talbot*.

Nan.—On May 3rd Messrs. Fife, of Fairlie, launched from their yard at Fairlie a very pretty modelled 6-ton yacht, built to the order of Mr. T. C. Burrowes, Lismore.

Gannet.—On May 5th there was launched from the shipbuilding yard of Messrs. David Macgill & Co., Irvine, the hull of a screw steamer, 135 ft. in length, 22 ft. in breadth, and 10 ft. depth of hold, with a carrying capacity of 280 tons. She is intended for the general coasting trade, was named the *Gannet*, and has been built to the order of Messrs. Steel & Bennie, of the Glasgow & Greenock Shipping Co. She is to be fitted with engines by Mr. William Kemp, Govan.

Hygeia.—On May 5th a saloon paddle steamer, named the *Hygeia*, of about 800 tons gross, was launched by Messrs. Napier, Shanks & Bell, at Yoker. The *Hygeia* has been designed for passenger service on Port-Philip Bay, Australia, the owners being Messrs. Huddart, Parker & Co., of Melbourne. After the launch the steamer proceeded to Greenock, where her machinery will be fitted on board by Messrs. Rankin & Blackmore.

Woodcock.—On May 5th Messrs. Fife, of Fairlie, launched from their yard the very handsome 10-ton yacht *Woodcock*, built to the order of Mr. A. Coats, from the designs of Mr. William Fife, jun. The christening ceremony was performed by Miss Jannie Fife, daughter of the builder. She will be commanded by Captain J. Macbryde, of Tighnabruiach.

Mana.—On May 6th Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched the paddle tug steamer *Mana*, built to the order of Timaru Harbour Board, New Zealand. She has been constructed under the superintendence of John Darling, Esq., Resident Director, Union Steamship Co., New Zealand, who represents the Harbour Board here. The *Mana* is to be fitted by the builders with two sets of independent compound surface condensing disconnecting engines to indicate 600 H.P.

Marchioness of Bute.—On May 6th Messrs. John Reid & Co., Port-Glasgow, launched from their shipbuilding yard the second of two saloon paddle steamers being presently built by them for the Caledonian Steam Packet Co., Limited, for coast traffic. On leaving the ways the vessel was gracefully named *Marchioness of Bute* by Miss Maud Williamson, daughter of Mr. James Williamson, the company's superintendent. The vessel will be fitted with compound tandem engines by Messrs. Rankin & Blackmore, of Greenock.

Buccaneer.—On May 6th a steamer was launched from the shipbuilding yard of Messrs. John Scott & Co., Kinghorn, built to the order of a London company. She is intended for the Mediterranean fruit trade. Dimensions:—Length, 217 ft.; breadth, 30 ft.; depth, 16 ft. The vessel, which was named the *Buccaneer* by Miss Bromage, London, was launched with steam up, and proceeded to Burntisland, where she will be fitted up for sea.

Kinghorn.—On May 6th Messrs. John Scott & Co., Kirkaldy, launched the *Kinghorn*, a steel screw steamer, 218 ft. by 30 ft. 5 in. by 14 ft. clear hold, classed 100 A1 at Lloyd's. She has been built to the order of Messrs. Tatham, Bromage & Co., London, and is specially adapted for carrying heavy machinery and large articles. Her main hatch is 60 ft. by 17 ft. She has no hold beams, but is strengthened by deep web frames, and has a large quantity of water ballast in cellular double bottom, divided longitudinally and transversely into several compartments. She was launched with steam up, steaming from the end of the ways into Burntisland. She went her trial trip on Thursday, and attained a speed, we are informed, of 12½ knots per hour over the five-mile run. The engines, which are triple-expansion, have cylinders 21½ in., 33 in., and 34 in. by 36 in. stroke, one large double-ended boiler for 160 lbs. working pressure. The vessel has been designed by Mr. Bromage, assisted by Mr. Meiklereid, for the special trade before mentioned, and is admirably adapted for it.

Hirondelle.—On May 7th a steamer of 1,450 tons gross register was launched from Messrs. Gourlay Bros. & Co's shipbuilding yard, Dundee, for the General Steam Navigation Co., London. The vessel, which was named the *Hirondelle*, is 280 ft. long, by 37 ft. 6 in. broad, and her hold is 19 ft. deep. She is built of steel, with iron plating, and has engines of 370 N.H.P., calculated to drive her at the rate of about 14 knots an hour. She has two steel decks and water ballast tanks, and is fitted with Davis's steam steering gear and Emerson, Walker & Co.'s patent windlass. The vessel, which has luxurious accommodation for a large number of first and second-class passengers, including smoking, music, and ladies' rooms, is intended for the Bordeaux and London express passenger service. She is fitted throughout with the electric light, including two signal lamps.

Barcraig.—On May 9th Messrs. William Hamilton & Co., Port-Glasgow, launched a handsomely modelled three-masted steel sailing ship, named *Barcraig*, of 2,100 tons register, to carry 3,480 tons deadweight. Dimensions:—Length, 267 ft. 10 in.; breadth, 41 ft. 7 in.; depth, 24 ft. 8 in. This vessel is to the order of Messrs. Hamilton, Harvey & Co., shipowners, Glasgow. She will mast at Greenock, take in ballast at Port-Glasgow, and load at Liverpool for Calcutta.

Vita.—On May 10th the s.s. *Vita*, built for the British India Steam Navigation Co., Limited, was launched from the yard of the Ailsa Shipbuilding Co., Troon. The *Vita* is a sister ship to the *Vasna*, launched in March last. She will be fitted with triple-expansion engines by Messrs. Dunsmuir & Jackson, of Govan.

Alcestis.—On May 15th Messrs. Mackie & Thomson launched from their shipbuilding yard, at Govan, the *Alcestis*, a finely-modelled steel screw steamer, of 1,850 tons gross, built to the order of Messrs. Aitken & Walker, Hope Street, Glasgow, and intended for their general trade. The vessel has been built to the highest class at Lloyd's, with scantlings in excess of their requirements, and her dimensions are as follows:—Length, between perpendiculars, 260 ft.; extreme breadth, 36 ft. 9 in.; depth, moulded, 24 ft. 9 in. She has been fitted with a cellular double bottom for water ballast, complete grain board arrangements for carrying grain in bulk, and all modern appliances for the rapid and noiseless loading and discharging of cargo, including steam windlass by Emerson, Walker & Co. The engines—which are of the triple-expansion type, with cylinders 19 in., 31 in., and 51 in. diameter by 39 in. stroke—have been constructed by Messrs. Muir & Houston, Harbour Engine Works. Steam will be supplied from two large boilers, each constructed for a pressure of 160 lbs. to the square inch. The *Alcestis* is a duplicate of the *Persia*, recently built by Messrs. Mackie & Thomson for Messrs. Aitken & Walker, and will be a handsome addition to the firm's already fine fleet of steamers.

Jessica.—On May 15th Messrs. W. Fife & Son, Fairlie, launched a very handsome 20-ton yacht, built to the order of Mr. Macdonough. The ceremony of naming the craft the *Jessica* was very gracefully performed by Miss Mary Fife.

Tencer.—On May 19th Messrs. Scott & Co., shipbuilders, Greenock, launched a steel screw steamer named the *Tencer*, of 2,800 tons gross register, for the Ocean Steamship Co., of Liverpool. The *Tencer*, which is a sister ship to the *Priam*, recently launched for the same owners, will be engined by the builders with Mr. Alfred Holt's usual type of compound tandem engines to indicate 1,500 H.P., and is intended to trade between this country and China.

Miefield.—On May 20th Messrs. Russell & Co., launched at Port-Glasgow a three-masted steel sailing barque of 1,320 tons net register, and of the following dimensions:—Length, 230 ft.; breadth, 36 ft.; and depth, 21 ft. 6 in. She was named the *Miefield*. Her owners are Messrs. Alexander Rae & Co.

Dunottar Castle.—On May 22nd the Fairfield Shipbuilding and Engineering Co. launched from their yard at Govan the *Dunottar Castle*, a mail steamer of about 5,000 tons gross, built to the order of the Castle Mail Packets Co., of which Messrs. Donald Currie & Co. are the managing owners. Her dimensions are as follows:—Length, 435 ft. over all; breadth, 50 ft.; depth, 36 ft. The vessel has been built entirely of steel, with a continuous cellular double bottom, and has eight vertical watertight bulkheads, which extend to the upper deck, and divide the vessel into nine compartments, minimising the risk in case of accident. Particular attention has been given to the accommodation for passengers, the ventilation, lighting, and sanitary arrangements being of the most improved and modern character. Lofty 'tween decks, with commodious reception and sleeping apartments, replete with every convenience, are provided. The promenade deck for first-class passengers extends for about two-thirds of the vessel's length. The first-class dining saloon, which is the full width of the ship, is seated for 160 passengers, while that reserved for second-class passengers, situated forward, will accommodate 100. The accommodation for third-class passengers is further forward still, and is approached from the upper deck by double companions with easy stairs. When completed, there will be a complete installation of electric light and electric bells on board, and a system of ventilation by means of compressed air throughout the ship. Her engines, which have been constructed by the builders, are of the triple-expansion type. The four large boilers have been throughout constructed under the supervision of the Board of Trade. There was a large company of ladies and gentlemen at the launch as the vessel left the ways. The christening ceremony was performed by Lady Currie and Mrs. Hitchen.

LAUNCHES—Irish.

Hawksdale.—On April 23rd Mr. Charles J. Bigge launched from the Foyle Shipyard a steel sailing ship, named the *Hawksdale*, of the following dimensions:—Length, 270 ft.; breadth, 40 ft.; depth of hold, 23 ft. 6 in.; register tonnage, 1,800; deadweight capacity, 2,900 tons. The *Hawksdale* has been built to the order of Messrs. J. Henry Iredale & Co., Liverpool.

Girouette.—On April 26th there was launched from the yard of Mr. James Doyle, yacht builder, Kingstown, a beautiful vessel from the design of Mr. E. Hamilton, who has already made his mark by the production of the *Falka* and *Ruddigore*, and from the appearance of the present vessel he is likely to very much increase his reputation as a designer. The *Girouette* is to all appearance as perfect as possible. Her dimensions are—Load-water line, 31 ft. 6 in.; length, over all, 45 ft.; beam, 7 ft. 6 in.; draft, aft, 7 ft. Her mast is 27 ft. from deck to hounds; boom, 34 ft.; gaff, 22 ft.; bowsprit, outboard, 15 ft., with a steadier of upwards of six tons of lead on her keel. She has a beautiful, long, clean entrance, which is carried well abaft the beam, and then merges into an equally clean run aft. Without the slightest hollow she has great freedom, with a slight tumble in from the water line up, which gives her a very graceful appearance. Her designer intends sailing her without a topsail, thereby keeping her sail area in the mainsail, jib, and foresail, which will show a surface of 1,140 square feet. Her builders' workmanship is the admiration of all who have seen the vessel. Her garboard and three strakes above are American elm, all the rest yellow pine, with teak steer strake and deck fittings. Her decks are splendidly laid, not a butt from stem to stern. Her keel was cast by Mr. Doyle in the yard alongside the vessel, and is all the ballast she will carry.

City of Dundee.—On May 3rd there was launched, at high water, from the Belfast shipyard, Messrs. Workman, Clark & Co., Limited, a fine steel screw steamer, named the *City of Dundee*, and built to the order of Messrs. George Smith & Sons, Glasgow. As the steamer left the ways the ceremony of christening the vessel was very gracefully performed by Mrs. John Workman. The dimensions of the vessel are as follows:—Length, 361·7 ft.; breadth, 42·6 ft.; depth, 29·4 ft. Gross tonnage, 3,300. She is built to class 100 A1 at Lloyd's, and is of the three-deck type, with two steel decks, and has a poop, bridge and topgallant forecastle. She will be principally engaged in the cargo trade, but has accommodation for a number of passengers under the bridge. The crew are berthed in the poop, the officers being in wing-houses under the forecastle deck, and the engineers under the bridge. The vessel is divided into eight watertight compartments. There are five cargo holds, with seven winches, derricks, and gangways to suit the working of cargo. The steam windlass and steam steering gear are of the latest and most improved type. The vessel will be rigged as a brigantine. The engines, of the most improved type of triple-expansion, are being constructed by Messrs. James Howden & Co., Glasgow.

Straight Fisher.—On May 8th a new steel screw steamer was launched from Messrs. M'Ilwaine & M'Coll's shipbuilding works at Belfast. The vessel, which was named the *Straight Fisher*, was built to the order of Mr. James Fisher, Barrow-in-Furness. Her dimensions are:—Length, 174 ft.; breadth, 26 ft.; and depth, 14 ft. She is fitted with triple-expansion engines.

Marlay.—On May 20th, at high water, there was launched from the Belfast Shipyard, Messrs. Workman, Clark & Co., Limited, Belfast, a fine steel screw steamer named the *Marlay*, built to the order of Messrs. Tedcastle & Co., Dublin. Her dimensions are:—Length. 200·3 ft.; breadth, 29·2 ft.; depth extreme to main deck, 16·8 ft. She will be classed 100 A1 in Lloyd's Registry. The *Marlay* is of the quarter-deck class, this deck extending forward to the main hatch, and has a topgallant forecastle. The main and quarter-decks are of steel, she will be schooner rigged, with two pole-masts. Every facility for the quick discharge and loading of the vessel will be provided. The engines, of the compound surface condensing type, are being constructed by Messrs. Victor Coates & Co., Limited, Prince's Dock Works, Belfast.

Plassey.—On May 22nd, at high water, there was launched from the shipbuilding yard of Messrs. Harland & Wolff, Queen's Island, Belfast, a fine steel screw steamer, built to the order of Messrs. Thomas & John Brocklebank, Liverpool, for the new line of steamers recently inaugurated by them to run between London and Liverpool and Calcutta. Her dimensions are as follows—Length, 345 ft.; breadth, 40 ft. 9 in.; depth, 30 ft. 2 in. Register tonnage, 3,200 tons. She will be schooner rigged, with two masts, and have poop, midship-house, and forecastle. In the midship-house will be the saloon, and accommodation for officers and engineers, the captain's room being above on the bridge deck, patent windlass and winches for rapid discharge of cargo will be provided. The engines, which will be supplied by the builders, are of the triple-expansion type, the boilers having a working pressure of 180 lbs. The ceremony of naming the vessel the *Plassey* was very gracefully performed by Miss Bond, daughter of Frederick W. Bond, Esq., London, chairman of the African Steamship Co. After the launch the vessel was towed to the finishing berths.

LAUNCH.—German.

Serapis.—The s.s. *Serapis*, built to the order of the Deutsche Dampfschiffahrts-Gesellschaft Kosmos, has just been launched from the yard of Messrs. Blohm & Voss, at Hamburg. The *Serapis* has been constructed in accordance with the requirements and under the supervision of the Bureau Veritas, and throughout of German steel. She is 320 ft. long, by 40 ft. beam, and has a depth of 27 ft. Her net carrying capacity is 1,183 tons. The triple-expansion engines are 1,300 H.P.

Tai-Yick.—On April 26th there was launched from the yard of the Flensburg Shipbuilding Co., in Flensburg, a steel screw steamer of the following dimensions:—Length, 250 ft.; breadth, 32 ft. 2 in.; depth, 22 ft. 6 in. The vessel has been built under special survey to Class 1st Div. at Bureau Veritas + and is of the spar-deck type. A cellular bottom for the water ballast is fitted fore and aft. The vessel is built for Mr. H. C. Edward Moyer & Co., in Hamburg, to trade on the Chinese coast. She was named *Tai-Yick* by Mrs. Edward Meyer, the wife of the owner.

LAUNCH—Danish.

Rusland.—On May 10th the new steamer *Rusland*, built for account of the Nordsöen Steamer Co., Copenhagen, was launched from the yard of Messrs. Burmeister & Wain, Copenhagen. She is 200 ft. long, 28½ ft. broad, and 15 ft. 4 in. deep from main deck to keel. She is built of steel with raised quarter-deck, and is intended for the cargo trade on the Baltic and North Sea.

LAUNCH—Norway.

Hanko.—On April 21st the steamer *Hanko* was launched from the Oker Engineering and Shipbuilding Co., Norway. She is the 124th boat launched from that yard and built for account of a syndicate at Frederikstad. Principal dimensions are:—Length, 135 ft.; breadth, 19 ft.; height, 15 ft. 10 in. to top deck. It has two fixed decks right through, and will be fitted as a first-class passenger steamer. There will be a handsome saloon, with good accommodation. The engine is a triple-expansion, and the contract speed 12½ to 13 knots. The boiler is made to 160 lbs. working pressure, and has forced draught arrangements.

LAUNCHES.—Haiphong.

Tac-cai and Yunnan.—On Thursday, February 20th, there were launched from the shipbuilding yard of the "Servie Subventionné des Correspondances Fluviales au Tonkin," Haiphong, two river steamers destined for the opening of navigation by the Red River to the Chinese frontier. The smaller of the two, the

Tac-cai, a light draft screw steam launch, is to be fitted with mining materials to blast the rocks in the channels of the Tai-cai and other rapids, which at present bar the way to the successful plying of steamers on the higher river; she was launched with machinery aboard, her draft, with all furnishings on board, being 1 ft. 9 in. mean. The second was named the *Yunnan*. She is a composite stern-wheel steamer of the same type as the *Laokay*, the boat built by the firm last year, which had the honour of being the first to reach China by the Red River route. The *Yunnan* is 136 ft. long over all, and 24 ft. beam, and has been entirely built in Haiphong, from the designs of Mr. W. C. Jack, the Ingenieur en chef of the service, to draw 24 in. with full equipment. On launching her draft was only 13 in., which was considered very satisfactory. On leaving the ways the Worshipful Master of the Tonquinese Masonic fraternity, Bro. Fellonean, sent her off with Masonic honours, Madame Gallay gracefully performing the baptismal ceremony, while Miss Jack did similar duty for the *Tac-cai*. On completion the *Yunnan* will be put on the Tan-quan line, where the *Laokay* has been so successfully engaged during the past year. After the launch Messrs. Marty & d'Abbadie entertained their employés to a banquet on board the *Dragon*, which steamer made a short cruise on the river with the guests on board.

TRIAL TRIPS.

Minnie Hinde.—On March 18th this fine steamer, the latest addition to the Hinde Line, Belfast, and which has been built and engined by Messrs. McIlwaine & Macoll, Limited, Belfast, to the order of Mr. William Hinde, Queen's Quay, Belfast, was taken down Belfast Lough on her trial trip. Her dimensions are:—Length, 180 ft.; breadth, 27 ft.; depth of hold, 14 ft. 3 in.; register tonnage, 218 tons; deadweight carrying capacity, 600 tons. She has been built under special survey for Lloyd's highest class; she has ballast tanks capable of holding 120 tons of water ballast, and is thoroughly suited for the passenger and general cargo trade between Belfast and Whitehaven. An installation of 54 incandescent lights, dynamo and engine, have been fitted by Crompton, of Chelmsford. Her machinery consists of triple-expansion engines, having cylinders 17½ in., 27 in. and 45 in. by 30 in. stroke, N.H.P. 120. One steel boiler, 14 ft. long, 10 ft. 6 in. diameter and 1¼ in. thick, three furnaces of the Farnley type, and in the boiler six of McMaster & Inley's patent valves for preventing the total collapse of furnaces are fitted. Maccoll's feed-water heater is also amongst other improvements fitted. The trial trip, which lasted for some hours, was in every way most satisfactory to all concerned. With the working pressure 160 lbs. and the engines running 90 revolutions per minute, 700 H.P. was indicated, the ship attaining a speed of 11·6 knots per hour on a consumption of 4½ tons of coal in 12 hours, equal to 1·2 lbs. per I.H.P. per hour. Her propeller is 11 ft. diameter and 12 ft. 6 in. pitch. Amongst those present on the trial trip were Mr. McIlwaine, Mr. Maccoll, Mr. William Fair, engineer surveyor, Board of Trade, Belfast, Mr. Maxton, Lloyd's surveyor, Belfast, Mr. Stelfox, manager, Belfast Gas Works, &c. &c.

Alexander Elder.—On April 19th this steamer, built and engined by Messrs. Harland & Wolff, Queen's Island, Belfast, to the order of Messrs. Elder, Dempster & Co., Liverpool, was taken on her trial trip in Belfast Lough. Her dimensions are:—Length 400 ft.; breadth, 40 ft.; depth, 32 ft.; gross tonnage, 4,000 tons. She has been fitted by the builders with triple-expansion engines of the most improved type, and steel boilers for a working pressure of 160 lbs. Amongst those present at the trial were Mr. Alfred Jones, Mr. A. Sinclair, of the African Steamship Co., Mr. Sievwright, Mr. Pirrie, Mr. W. H. Wilson, Mr. Pratton, managing engineer, Messrs. Harland & Wolff, Mr. J. G. Garrick, Mr. G. W. Frost, Mr. Withers, &c. After the compasses were adjusted a number of runs were made, everything running smoothly, and at 5.30 p.m. the ship headed for Liverpool. The *Alexander Elder* has been chartered by Messrs. Johnston & Co., Liverpool.

Palamcotta.—On April 22nd the British India Co.'s steamer *Palamcotta*, 3,500 tons, built by Messrs. A. & J. Inglis, Pointhouse, completed the first of a series of trials which it is intended to carry out under various conditions of lading, fuel consumption, &c. The results obtained were in close agreement with the estimate of performance, and the working of the machinery left nothing to be desired. The *Palamcotta* is a steel built vessel with cellular double bottom, 360 ft. in length by 42 ft. broad and 29½ ft. deep. Her deadweight capacity is 4,500 tons, and she has spacious and elegant accommodation for first and second-class passengers in poop and bridge-house. She is fitted with all the usual accessories of the most improved type and by the best makers. The company was represented by Captain Hodgkinson, R.N., Mr. John Clark, Mr. P. W. Armour, Captain Stone, &c., who expressed their intention of reporting in the highest terms on the performance of the vessel.

Claudine.—On the 25th April the steel screw steamer *Claudine*, built by Messrs. Napier, Shanks & Bell for Mr. Claus Spreckels, of San Francisco, under supervision of Messrs. Geo. Gray Macfarlane & Co., was tried over the measured mile, preparatory to leaving for Honolulu, where she is to be engaged in service between the Hawaiian Islands. This vessel has been constructed to the highest class at Bureau Veritas, has long poop, monkey forecastle, and large deckhouses forward and aft of machinery space, with shade deck overhead. The saloon is entered through a handsome stairway from poop deck, having on both sides commodious state rooms, which, with additional rooms on deck above, afford sleeping accommodation for 60 first-class passengers. The vessel is fitted throughout in the highest style, with electric light, electric bells, &c., and as usual Messrs. J. G. Rowan & Co., Glasgow and Greenock, have displayed great taste in the upholstery work. The engines, by Messrs. Dunsmuir & Jackson, indicated over 1,000 H.P., and worked with great smoothness. Among the company present were Mr. George Gray Macfarlane and Mrs. Macfarlane, Mr. and Mrs. Duncan Fullerton, the Misses Fullerton, Mr. D. M. Dodd, Captain A. R. Brown, Japanese Consul; Captain Hay, Mr. Lucas (Bureau Veritas), Mr. J. B. Stevenson, Miss Binnie, Miss Comrie, Mr. A. M'Crindell, Mr. Robert Connel, Mr. Palmer.

Heung Shan.—On April 25th the twin-screw steamer *Heung Shan*, 290 ft. long, 54 ft. beam, 21 ft. depth, moulded, and 2,700 I.H.P., recently launched from the yard of Messrs. Ramage & Fergusson, Leith, had her official speed trials on the measured mile with most satisfactory results, the mean speed being 15·17 knots. The conditions of speed and draught were of the most stringent nature, and it is satisfactory to note that in both the builders had a substantial margin over their contract. The steamer is the property of the Hong Kong and Macao Steamship Co., and is their second steamer by the same builders. This vessel, which is designed to carry an enormous number of passengers, was during her construction superintended by Mr. Geo. Walker, of 95, Leadenhall Street, London. The steamer will be manned by a Chinese crew, and after taking in coal, will leave Leith for Hong Kong under the command of Capt. Brock, who took out the company's last steamer.

Dominion.—On April 26th the fine new steamer *Dominion* left the river Mersey on her voyage, after having her machinery converted to triple-expansion, and new boilers, with working pressure of 160 lbs. per square inch, fitted to her. The *Dominion* is owned by the Mississippi and Dominion Steamship Co., of Liverpool, and is a vessel of 3,176 gross tonnage. She is 335 ft. long, 38½ ft. beam, and 25¾ ft. of hold. The cylinders are now 26 in., 41 in., and 66 in. diameter respectively, and all have a stroke of 45 in. All the work, with the alterations to machinery, has been carried out by Messrs. David Rollo & Sons, of Liverpool, under the direction of Mr. Glover, the company's superintendent engineer, and Mr. Lemon, the marine superintendent. On the way down the river the machinery was tested, and gave great satisfaction, the engines working very smoothly at 63 revolutions per minute, the vessel's speed loaded being about 11½ knots during the run.

Stern Wheeler.—On April 28th Messrs. Kincaid & Co., engineers, Greenock, had a successful trial of the machinery of a stern-wheel steamer built for the Imperial British East Africa Co., and afterwards shipped for Mombassa, where she will be put together and used in navigating the rivers in the company's new territory.

Sarmatian.—This well-known steamer of Messrs. Allan's Montreal Mail Line the *Sarmatian* has recently been entirely refitted with new engines and boilers by Messrs. James Howden & Co., Glasgow, and has undergone considerable alterations in her internal arrangements in order to make her more suitable for cargo purposes—the great saving in space effected by the new machinery permitting of a large increase to the cargo-carrying capacity. The new engines have cylinders 25 in., 42 in., and 68½ in. diameter and 48 in. stroke, and are supplied with steam from two single-ended boilers 15 ft. diameter by 11 ft. 9 in. long, with three furnaces 3 ft. 7½ in. diameter in each, the working being 160 lbs. These boilers are capable of supplying steam to the engines working at 2,500 I.H.P., being fitted with Howden's patent system of forced draughts, now being used in all the new steamers for the Allan Line. On the trial trip, which was made at the end of April before the sailing of the steamer for Canada, the engines were worked during a continuous high-speed run of eight hours with admirable smoothness and efficiency, and without the slightest heat in any of the working parts, to the entire satisfaction of Messrs. Allan's representatives, and all on board. Messrs. James Howden & Co. have also on hand for Messrs. Allan new machinery for the conversion of their mail steamer *Peruvian* to high-pressure working, the boilers being likewise fitted with Howden's patent forced-draught system.

Beacon Light.—On April 29th the trial trip of the tank steamer *Beacon Light*, built at the Walker yard of Sir W. G. Armstrong, Mitchell & Co., for Messrs. R. Stewart & Co., Liverpool, took place off the Tyne. The vessel is built of steel, for the carriage of petroleum in bulk, and she has a deadweight capacity of 4,200 tons. For dealing with her cargo two powerful Worthington pumps are fitted. Electric light has also been fitted throughout the vessel. The engines are of the triple-expansion type by the Wallsend Slipway and Engineering Co. After adjusting compasses, the vessel made several runs on the measured mile, and attained a mean speed of about 11 knots. During the trial the machinery ran without the slightest hitch, and gave every satisfaction.

Buccaneer.—Last April Messrs. John Scott & Co., of Kinghorn, Fife, launched the steel screw steamer *Buccaneer*, ready for sea, and she afterwards made her trial trip on a run to the Forth Bridge and back to Leith, proving herself to be a very fast vessel. Her dimensions are:—218 ft. by 30 ft. 1 in. by 16 ft. 4 in., with triple-expansion engines of 21½ in., 35 in., and 54 in. by 36 in. stroke and 180 N.H P. This vessel was built to the order of Messrs. Tatham, Bromage & Co., for their special fruit and machinery carrying trades, and she was specially constructed from Mr. Bromage's designs for the carriage of unusually large packages, being capable of taking into her holds such cargo as torpedo boats, barges, &c., up to 85 ft. long. She has appliances for lifting up to 40 tons, and has been built exceptionally strong under the supervision of Lloyd's.

Concurrent.—On April 29th this vessel, which has been built by the Flensburg Shipbuilding Co., at Flensburg, for Mr. H. A. Petersen, at Flensburg, was taken on her trial trip with very satisfactory results. Dimensions of the vessel are:—Length, 200 ft.; breadth, 30 ft. 6 in.; depth, 15 ft. 9 in. Her engines are built by the Flensburg Shipbuilding Co., on the triple-expansion principle, 350 H.P. The vessel and engines have been superintended by Bureau Veritas to Class 1st Division +. With an average speed of 9¾ knots the coal consumed was only 1·4 lbs. The steamer is intended for trading on the North Sea and the Baltic.

Hounflow.—On May 1st this steamer, 314 ft. by 40 ft. 6 in. by 22 ft. 2 in., built by Messrs. Wm. Gray & Co., West Hartlepool, for Messrs. Watts, Ward & Co., London, left West Hartlepool for her trial trip. Her engines are of the triple-expansion type, of 190 N.H.P., having cylinders 23 in., 37½ in. and 61½ in. in diameter, by 39 in. stroke, and working at 160 lbs. pressure, and were built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working satisfactorily, the vessel attaining a speed of about 11½ knots.

Minho.—On May 1st the trial trip took place of the steamer *Minho*, built by Messrs. J. Jones & Sons, of Liverpool, for Messrs. F. Leyland & Co., for the Lisbon fruit trade. The *Minho* is a flush-decked steamer with topgallant forecastle and bridge. She is of the following dimensions:—217 ft. by 27 ft. by 15 ft. 6 in. The machinery is ordinary compound, the dimensions of the cylinders and range of expansion being proportioned to suit the higher worked pressure of 160 lbs. The engines are fitted with Morton's valve gear, and the performance of the engines was highly satisfactory. The trial trip, extending over nine hours, was, we are informed, unattended by the slightest hitch, the machinery running cool, and developing a higher power than expected. The steamer has the highest class with Lloyd's, has steam steering gear, and other modern appliances; and has been delivered up to date, and to the entire satisfaction of the firm for whom she has been built. Messrs. Jones have four other steamers on the stocks, and they will not have a vacant slip before the end of June.

Prince.—On May 1st the steamer *Prince*, built at Merksworth Shipbuilding Yard, Paisley, by Messrs. John Fullerton & Co., went down the Clyde on her official trial trip. Compasses having been adjusted, and the steamer fully laden with coal, the owners and a numerous company of gentlemen went on board at Greenock, and at once proceeded to Wemyss Bay to run the measured mile, which was done to the satisfaction of all on board at the rate of 9½ knots per hour. The *Prince* has been built to the order of Messrs. J. & J. Hay, 58, Renfield St., Glasgow, for whom the builders have another steamer on the stocks, nearly ready for launching. The engines, which are on the triple-expansion principle, were supplied by Messrs. Muir & Houston, and worked admirably during the trip.

Managua.—On May 2nd the new steel steamer *Managua*, built by the Grangemouth Dockyard Co., Grangemouth, to the order of Mr. Johan C. Giertsen, of Bergen, for the fruit trade between the West Indies and New York, went down the Firth of Forth on her trial trip on the measured mile, an average speed of 11¼ knots an hour was obtained. The machinery has been supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow, and worked very smoothly, giving every satisfaction to all concerned. The *Managua* has been built to the Norwegian Veritas highest class, under the superintendence of Captain Früs, who will command her.

Clacton Belle.—On May 2nd this vessel, built by Messrs. W. Denny & Brothers, Dumbarton, for the London, Woolwich and Clacton-on-Sea Steamboat Co., for daily passenger service between London and Clacton-on-Sea, had her trial trip, running over a distance of more than 100 miles at full speed, with and against the tide, made an average speed of 19¾ miles per hour, the speed over the measured mile being over 20 miles an hour. The vessel is 250 ft. by 26 ft. 6 in. breadth by 17 ft. 3 in. depth to top of promenade deck.

Cyrnos.—This steamer, built and engined by Messrs. David J. Dunlop & Co., Port-Glasgow, for Messrs. Fraissinet & Co., Marseilles, has made her official speed trials, when, during a six hours' run, a mean speed of 14½ knots was obtained, the vessel being loaded with 300 tons of deadweight. At the trials for consumption the results obtained showed an economy, during a 6½ hours' trial, of 10 per cent. on the quantity allowed by contract to the builders for their guaranteed speed of 13½ knots. The *Cyrnos* is of the following dimensions:—Length, 225 ft.; beam, 29 ft.; depth, moulded to hurricane deck, 15 ft. 10 in. The steamer has been specially designed for the passenger and cargo service between Marseilles and Corsica. The machinery is of the builders' own design of three cylinder engines, the diameter of cylinders being 22½ in., 36 in., and 60 in. by 42 in. stroke. Steam is provided by two large double-ended boilers, the working pressure being 150 lbs.

Yumuri.—On May 6th the s.s. *Yumuri*, a steel screw steamer, which has been built by Messrs. Raylton, Dixon & Co., Middlesbro', proceeded from the Tees on her trial trip. This vessel, which has been built for P. G. Petterson, Esq., of Bergen, is of the following dimensions:—Length, 204 ft.; breadth, 28 ft.; depth, moulded, 21 ft. 10 in.; with a carrying capacity of about 1,070 tons. She is built to Lloyd's spar-deck rule to class 100 A1, and is intended for the fruit trade from the West Indies to New York, for which she is fitted. Her holds are specially insulated, warmed, and ventilated. Her accommodation for officers and passengers is all on deck in handsomely fitted teak houses. Her engines have been supplied by Messrs. Westgarth, English & Co., Middlesbro', having cylinders 17½ in., 29 in., 47 in. by 33 in. stroke, and attained on trial 11½ knots speed.

Matteo Premuda.—Early on Tuesday morning, May 6th, the screw steamer *Matteo Premuda*, recently launched by the Blyth Shipbuilding Co., Limited, from their building works at Blyth, for Austrian owners, was taken to sea with a full cargo of coals on board for adjustment of compasses and the usual trial trip. During the forenoon, a party of gentlemen representing the shipbuilders, owners and engineers, proceeded by tug to the vessel at sea, when the usual trial of speed was made over the measured mile, when a good speed was obtained. After spending an enjoyable afternoon at sea, the vessel was brought back to Blyth. The *Matteo Premuda* is 228 ft. long, by 32 ft. breadth, and 16 ft. 4 in. depth of hold, and has been built to Lloyd's highest class, and is fitted throughout in the most complete manner. The engines are by the North Eastern Engineering Co., Limited, of Wallsend, and are of the triple expansion type, with cylinders 16½ in., 26½ in. and 43½ in. by 33 in. stroke. The construction of the ship and engines have been under the supervision of Mr. D. Meiklereid, M.I.N.A., of London, and Captain Premuda will take command.

Philadelphia.—On May 7th the new U.S. cruiser *Philadelphia* was taken on a preliminary trial trip on the Delaware River. The engines working at 118 revolutions per minute, with a steam pressure of 154 lbs., a speed of 20·74 knots an hour was obtained, and she maintained this speed for 3½ hours.

Magicienne.—On May 8th the *Magicienne*, the first cruiser of the M class detailed for ordinary service, made a three hours' commissioned trial of her engines at Portsmouth, preparatory to proceeding to the west coast of Africa. The trial proved more than usually successful, the mean power developed being over her natural draught contract power, though neither picked coal nor special stokers were made use of. Her trim was 15 ft. forward and 19 ft. aft. The average air pressure in the stokeholds was under ⅜ in., although the Admiralty regulations permit of ½ in. The collective I H.P. realised was 5,526, and the mean speed 16¼ knots, or nearly the same as was obtained at the contractors' trial, under exceptional conditions, and with the maximum air pressure permitted. The temperature in the engine and boiler-rooms was all that could be desired, the surfaces of the steam pipes, boilers, and cylinders having been coated with fossil powder, and additional ventilating trunks and cowls fitted. The highest temperature recorded was 97° Fahr.

Tank Steamer.—On May 8th a new tank steamer, built at Lindholmen, Gothenburg, Sweden, had a satisfactory trial trip. With full cargo it made a speed of over 9 knots. The steamer is 155 ft. long, 27¾ ft. broad, and 9½ ft. in the water, with 530 tons cargo. The steamer proceeds at once to St. Petersburg, and from there through Russia to Baku.

Cushing.—The United States torpedo boat *Cushing* has had her trial trip. The hull and motive machinery have been built by the Herreshoff Manufacturing Co., Bristol, Rhode Island. The length of the boat is 138 ft.; depth, 10 ft.; and extreme draught of hull, 4 ft. 4 in., though the rudder extends below the keel. The peculiarities of the new boat are her exceedingly light draught, fine lines, partly balanced rudder, inboard caps of the torpedo tubes (to avoid the spray-making effects of outward caps, which would lead to detection in night attacks), and the overhang guard rails, which are intended to protect the twin screws (these projecting beyond the sides of the hull) in case of collision, the extreme beam being only 15 ft. Tried on the Potomac, the *Cushing* attained a speed of nearly 27 knots an hour. While steaming at the rate of 25 knots an hour, her engines were suddenly reversed, and she backed at the rate of 18 knots an hour. She also turned within her own length. The result is four knots beyond the speed contracted for.

Bute No. 2.—On May 10th the twin screw steamer *Bute No.* 2, of the following dimensions:—Length, 116 ft.; breadth, 22 ft.; depth, 9 ft., built by Messrs. Scott & Co., Bowling, for Messrs. Hill & Co., Broomielaw, Glasgow, for their coast trade, went on her trial. The engines, which are of the compound type, with cylinders 12 in. and 23 in. diameter, by 18 in. stroke, were constructed by Mr. William Kemp, Glasgow. During the trial the machinery ran with smoothness, and without any hitch whatever. The owners, who were on board, expressed themselves highly satisfied with the results obtained.

Monrovia.—On May 12th the s.s. *Monrovia*, a steel screw steamer which has been built for Messrs. Elder, Dempster & Co., of Liverpool, by Messrs. Raylton, Dixon & Co., proceeded from the Tees on her trial trip. She is built to Lloyd's partial awning deck rule, with accommodation for passengers in poop aft. Dimensions:—Length over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight carrying capacity of about 3,600 tons. She is specially strengthened above Lloyd's requirements, with doubling strokes, has all her decks sheathed with wood, and is in very many respects more completely fitted than the usual cargo boat. Her engines have been supplied by Messrs. T. Richardson & Sons, Hartlepool, of 190 N.H.P., having cylinders 22 in., 35 in. and 59 in. by 39 in. stroke, which gave every satisfaction on the trial run, developing a speed of 11½ knots half loaded. She will be employed in the West African trade of her owners, and on completion of her trial proceeded to Hamburg to load.

Bear Creek.—On May 13th the tank screw steamer *Bear Creek*, built by Sir W. G. Armstrong, Mitchell & Co., was taken to sea for her trial trip. The vessel is built of steel for the carriage of petroleum in bulk. She has a deadweight carrying capacity of about 3,500 tons, and for dealing with her cargo there are two Worthington pumps. Electric light is also fitted throughout the vessel. The engines are on the triple-expansion system, and were made by the Wallsend Slipway & Engineering Co. After adjusting compasses, the vessel was taken over the measured mile off Tynemouth, and after making several runs a mean speed of 11 knots was attained, the machinery working without the slightest hitch. The *Bear Creek* has been built for the Bear Creek Oil and Shipping Co., London.

Girdleness.—On May 13th this vessel, 270 ft. by 37 ft. by 18 ft. 1 in., built by Messrs. Richard & Duck, Stockton, for Messrs. Farrer, Groves & Co., London, left the Tees for her trial trip. Her engines are of triple-expansion type of 150 N.H.P., having cylinders 21 in., 34 in., and 56 in. in diameter, by 36 in. stroke, and working at 160 lbs. pressure, and were built by Messrs. Blair & Co., Stockton. The *Girdleness* made a most successful run, everything working satisfactorily and the vessel attaining a speed of about 10 knots.

Ingleby.—On May 14th the s.s. *Ingleby* was taken on trial in Tees bay with very satisfactory results. She is of the following dimensions:—260 ft. by 36 ft. 6 ft. by 19 ft., moulded, built by Messrs. R. Craggs & Sons, for Messrs. Ed. Harris & Co., Middlesbro'. The vessel was deep loaded and sailed immediately afterwards for Alexandria; speed, 10 knots; I.H.P., 920; engines, 20 in., 33 in. and 54 in. by 36 in. stroke, with two extra large steel boilers, 161 lbs. pressure, by Messrs. Westgarth, English & Co., of Middlesbro'.

Standard.—On May 14th the steel tank screw steamer *Standard*, built at the Walker shipyard of Sir W. G. Armstrong, Mitchell & Co., for the Deutsch-Amerikanische Petroleum-Gesellschaft, was taken to sea for trial. She has been constructed for the carriage of petroleum in bulk, and has a deadweight carrying capacity of about 4,000 tons. Electric light is fitted throughout the vessel. The engines are on the triple-expansion system, manufactured by the Wallsend Slipway and Engineering Co., and her boilers are fitted with assisted draught on the closed ashpit system. After adjusting compasses a speed trial was made off the Tyne, when a mean speed of 10¾ knots was attained with the vessel fully loaded. A very careful series of consumption trials were also made, both with natural and assisted draught, with entirely satisfactory results, the engines working during the whole day without a hitch.

Storm King.—On May 15th the s.s. *Storm King*, a steel screw steamer which has been built by Messrs. Raylton, Dixon, & Co., Middlesboro', to the order of Messrs. W. Ross & Co., London, took her trial trip from the Tees. This vessel is built on the three deck rule having full poop aft for accommodation of first-class passengers, bridge-house amidships and topgallant forecastle. Her dimensions are:—Length, 351 ft.; breadth, 42 ft. 6 in.; depth, moulded, 29 ft. 6 in.; having a deadweight capacity of about 5,000 tons. She is fitted throughout with an electric light installation. Her engines have been fitted by Messrs. Thos. Richardson & Sons, Hartlepool, having cylinders 28 in., 48 in., and 72 in. by 48 in. stroke, which gave full satisfaction, developing near 13 knots on trial. This vessel has been constructed under the superintendence of Mr. Jas. Crawford, of Sunderland.

Simon Dumois.—On May 15th the new steel steamer *Simon Dumois*, built by the Grangemouth Dockyard Co., at Grangemouth, went down the Firth of Forth on her official trial. The engines, which have been constructed by Messrs. Hutson & Corbett, of Glasgow, are of the latest tri-compound type. They worked smoothly throughout the day, and gave great satisfaction to all concerned. On the measured mile she attained a speed of 12 knots, and a mean speed of several runs of 11½ knots, which is considerably over the guarantee. The *Simon Dumois* has been built to the order of Messrs. Bergh Holland, of Bergen, and has the highest class in Norwegian Veritas, spar decked. She has been designed and specially built for the fruit trade between the West Indies and United States, and is fitted with all the latest improvements for working both ship and cargo, steam steering gear, hold insulated and heated with steam, and an exhausting fan for keeping up a supply of fresh air. The cabins are handsomely fitted up, and accommodation provided for a number of first-class passengers. Captain Kaunitz, who has superintended her construction on behalf of the owners, will take command.

Lomas.—On May 17th the s.s. *Lomas*, built by Messrs. Raylton, Dixon, & Co., Middlesbro', proceeded from the Tees on her trial trip. This vessel has been built to the order of Messrs. Arthur Holland & Co., London, and is on the web-frame principle, having poop, raised quarter-deck, and topgallant forecastle, her chief dimensions being:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; with a deadweight capacity of about 3,300 tons. Her engines have been built and fitted by the North Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, which proved very satisfactory on the trial run, giving a speed of 11 knots. She has been built under the superintendence of Mr. Barclay for her owners.

Langoe.—On May 20th the screw steamer *Langoe* proceeded on her trial trip in the bay of Hartlepool, making a very satisfactory performance. She is a vessel 300 ft. in length; breadth, 38 ft.; depth, 22 ft. 2 in.; and was built by Messrs. William Gray & Co. for Mr. Christopher Furness, who named her the *Calcutta City*. Before proceeding to sea, she was sold to Messrs. Bennett & Son, Grimsby, who have changed her name to that of *Langoe*. She is fitted with central engines on the triple-expansion principle, the diameters of the cylinders being 21½ in., 35 in., and 58 in., with a stroke of 39 in. After adjusting compasses, she made an hour's run out and home again, with her log overboard, when the speed was found to be precisely 12 knots per hour. The engines were running continuously at 80 revolutions per minute, there being no sign of heating whatever, and no water applied to the bearings.

Reviews.

The Marine Transport of Petroleum. By George Herbert Little. London: E. & F. N. Spon. 1890.

It appears to be the rule in the present day that even before an industry has obtained a full footing something should be published concerning it. Doubtless there are good reasons for this. The very fact that a new order of things has sprung up renders it necessary that those interested should be educated accordingly. It may be taken that the work under notice is intended to enable shipowners, captains, and engineers, who are for the first time brought into contact with the carriage of petroleum, to deal successfully with the problems that they will experience. The author does not pretend that there is much that is really original in what he has published, but rather that he has got together all that has previously been written on the subject. When we say the volume runs through 250 pages it will be understood that a good deal has been done to make the public familiar with the progress in this department.

The work is divided into seven chapters, the first of which treats of the various modes in which petroleum is found distributed throughout the world, its properties and value, from its numerous standpoints. Here we find mentioned the dangers of the article, as also how to indicate when it is safe. Its bye products are also introduced, and as regards one of them, astaki, it is believed we are behind foreign nations in taking advantage of its use as a liquid fuel. To the uncertainty about petroleum is attributed its want of success in steamers. In time, however, it is thought we shall be able to live up to it as we have done with forced draught and other new ideas. The explosions that have occurred on steamers are said to have been due to carelessness and ignorance on the part of those engaged. The enthusiasm that is infused throughout the pages of this work may be gathered from the remark that in the next generation we may expect to find oil depôts the primary care of a Government instead of coal as at present.

In the second chapter the primary elements of ship design come in for notice as leading up to the peculiarities of tank steamers, and that vexed question for those in charge of vessels, what is the stability, under varying circumstances, of load. In the middle of the third chapter we are brought to the difference between petroleum and other cargoes as regards safety of the ship at sea. It is only when the level of the oil in the tanks subsides that any difficulty is experienced under this head. To meet such a possible emergency subdivision is resorted to. It is to the proper disposition of bulkheads and water ballast spaces about which there is any dispute. There is also their loading and unloading in due order to prevent unequal strains and any risk of capsizing. Most important of all, probably, is the question of leakage as endangering the ship, and leading to depreciation of the cargo by the oil becoming admixed with water. A tank ship is therefore thought to be quite a boilermaker's job for obvious reasons. We next find several types of petroleum-carrying steamers in these pages. The examples are not peculiar to this country. There are Russian and American specimens as well as English. The latest practice of building in the vessel smaller expansion tanks above the level of the main ones is noticed. In these the oil is kept at about half the height, and this allows for any variation due to difference of temperature, and without interfering with the bulk of the cargo which remains constantly at the top of the large holds. The vessel's stability is always assured by these means. It appears to be usual in oil-carrying vessels to place the engines and boilers quite aft, the water ballast in two tanks fore and aft, which thus cuts off the oil tanks from the rest of the ship. In the latest steamers for the purpose the oil is next to the outside skin, double bottoms being dispensed with. According to the author, curves of stability are not obtainable for the most recent type of this class. Looking at the plans there is no reason to doubt the safety of these boats, if they are loaded and unloaded properly. It is argued that a well designed ship may be used for other cargoes by removing all traces of the petroleum, and directions are given for doing this.

In the fourth chapter efficient pumping appliances are dealt with, and the manipulation required in filling the tanks gone into with the pumps continuously at work on the quay. The same with discharging. The necessity of carefully cleaning the tanks between two cargoes, say of refined and crude oil, is enjoined on those in charge, as the former will be damaged by any addition of the latter. Our readers must be referred to the book itself for the numerous directions connected with the pumping arrangements, and the necessity of these being kept separate from the engine-room entirely. Leakage is not admissible in a tank steamer. If it does occur we find here what is to be done to put an end to it. Mention is made of the possible explosions that may follow from the employment of wooden decks in these boats, if they become saturated with oil, as in some cases of ignorance they are allowed to do. With a mixture of 1 part of petroleum vapour to between 8 and 15 of air we have a violent explosive. With a proportion of air on either side, however, of this we are told there is little or no danger. Good ventilation is, therefore, recommended, especially when loading and unloading, as also the avoidance of smoking and naked lights of any sort.

As electric lighting cannot be dispensed with on an oil transport, the author goes into this matter somewhat closely in his sixth chapter. He does not recommend the single wire system for the reason that salts form on the joint between the lamp wires and the ship's skin, and produce resistance. There is then the danger that a fire may occur. He has found the mistake of steam being taken for the dynamo engine from a winch steam pipe, with the result that the lights bob up and down when the winch is running. Lastly, we are brought to general directions applying to the use of dynamos on board ship, and the mode of starting them, &c., and also the various details of wiring and keeping this branch in order.

Our readers will see that a very interesting and instructive volume has been published above the average of technical works in general. When we add that in the last chapter we find a collection of useful tables referring to pumping engines, pipes for conveying oil, stowage of oil and other ships' necessaries, capacities of tanks, casks, &c., together with the vocabulary of likely terms in vogue on board ship in English, German, and Russian, it will be gathered that all those concerned have in this volume a handy manual to which to refer at any time for useful information.

Practical Marine Surveying. By Harry Phelps, U.S.A. New York: John Wiley & Sons. 1889.

This volume was prepared at the request of the authorities of the U.S. Naval Academy, Annapolis, by an officer who was engaged for six years in practical surveying. It may therefore be taken to be the standard work on this subject in use in the United States. First, the instruments required come under notice, and any repairs that may be necessary to them at sea are explained. As a further preparation for survey operations, the different signals usually adopted are then described. The reader is shown how a base line being taken, main triangulation afterwards follows. The details of plotting are then gone into most minutely and we come to shore line work or secondary triangulation. A lengthy chapter is devoted to topography, that is, where it is desired to represent somewhat closely the interior of the country contiguous to the coast line. The various ways of taking soundings, and the machines used for this purpose, absorb two more chapters. This branch of the subject is fully worked out.

The determination of different heights of all the prominent points within the limits of a survey is next shown. Tidal observations are very necessary that the charts may be reduced to a uniform level, which is generally that of mean low water. The instruments used for this purpose are explained, as also the several terms employed in reference to tides. As the chief stations fixed upon in a survey must be accurately placed on the chart, the ways of finding the latitude and longitude and true bearings are noted. Finally the errors due to variation of the compass come in for a proper share of attention, and if there is not a requisite time allotted for going through a survey in the orthodox fashion, what is called a running survey is brought to the reader's notice. A description of the transit and equal altitude instrument completes the volume. While there does not appear to be anything novel in this work, the fact of the source from which it emanates may make it of considerable value to all officers charged with making marine surveys. Illustrations and diagrams are interspersed where necessary.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

REPAIRING DAMAGE AFLOAT.

To the Editor of The Marine Engineer.

Sir,—I have great pleasure in forwarding you the enclosed letter and sketches, hoping they will be acceptable to your columns and interesting to your readers:—

The s.s. *Caloric*, of Glasgow, was proceeding to sea from the port of Bilboa, on the 2nd of February last, with a cargo of 2,300 tons of iron ore, when she touched the ground, and her stern in swinging round came in contact with some stones forming the foundations of the Bilboa West Pier, as there was a little swell on the bar at the time it caused the ship to bump considerably on her heel, and thereby broke the rudder short off at the 22 ft. mark. Also the rudder post gave way at the 15 ft. mark, and at the bottom close to the main stern post, and it and the rudder fell into the sea, breaking off a blade of her propeller at the same time.

The vessel was eventually towed off, and moored in the river near St. Nicholas, where she showed at low water to the 15 ft. mark. The vessel at the time of the accident drew 18 ft. of water fore and aft.

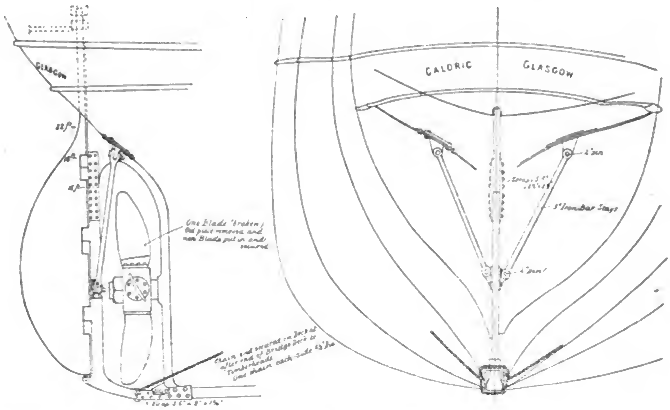
Mr. John Moffat, a resident engineer in Bilboa, undertook, if the broken part of the rudder and stern frame were recoverable, to secure them in their respective places without the vessel discharging *any of her cargo*, to the entire satisfaction of the master and Lloyd's surveyor.

A diver was sent down to the river entrance, and succeeded in recovering the broken parts aforesaid. The broken part of the rudder-head was removed from the tiller and rewelded to the rudder. Strong strap plates were riveted on each fractured part of the stern frame or rudder post, and these were secured to the original fractured parts by tap bolts and check nuts.

Then two strong doubling plates with strong eyes were fitted under each counter, and corresponding eyes were riveted on to the rudder post, in a line with the shafting. These eyes were connected by two solid 3-in. stays, and connected to the aforesaid eyes with strong steel pins.

Also a shoe plate was fastened on top of the strap plates, right in the wake of the lower part of the fractured rudder post; and here a chain was secured, one part leading on each side of the vessel upwards and set taut up, at the after part of her bridge.

When all the tap bolts were set well up, and all interstices in the strap plates securely wedged, to prevent working, the vessel proceeded on her passage, arriving off the Tail of the Bank Greenock on February 26th all well, and it was found on docking the vessel nothing about the temporary repairs had started, and were exactly in the position in which they were when she left Bilboa. This vessel had a heavy sea to contend against crossing the Bay of Biscay.


GLASCOW
22 ft
16 ft
15 ft
One Blade (broken) Old piece removed and new Blade put in and secured
Chain and secured on Deck at after end of Bridge Deck to Timberheads One chain each side 1½ in
CALORIC
GLASGOW
2 in pin
3" Iron Bar Stays
2 in pin

The most of this work had to be done under water (with assistance from above), therefore it reflects great credit to all concerned in the undertaking, at least, sir, this is the general opinion here in Bilboa, therefore you may perhaps think it worthy of a niche in your valuable journal. I may add, the portable blade of the propeller (the broken part) was removed, and a new blade fitted, and that the vessel made a good and quick passage home. Trusting I have not wearied you, Mr. Editor, with the length of my detail, and thanking you in anticipation of the letter's publication,

I have the pleasure to remain, Sir,
Yours very obediently,
John Todd.
Commanding s.s. *Heathpool*, of Sunderland.
Bilboa, April 20th, 1890.

THE S.S "METEOR."

To the Editor of THE MARINE ENGINEER.

SIR,—In answer to the query by your correspondent "D. R." in this month's issue, with reference to the difference of power developed by *Meteor's* L.P. engine, with and without the jacket steam on, I can only say I have not had cards taken without the jacket, but from my former experience with a compound engine, indicating over 2,500 H.P., the I.H.P. and revolutions were greater with the jacket on than without. If you would kindly publish a set of diagrams from *Meteor's* engines, with and without the L.P. jacket under the same conditions, for the interest of your readers, I will get a set of each sent to you in the course of a few weeks, as soon as the *Meteor* goes on her regular station again.

I am, yours, &c., R. YOUNG.

Leith, May 22nd, 1890.

Miscellaneous.

NEW STEAMERS FOR THE ORIENT LINE.—Two magnificent new steamers, named respectively *Orotava* and *Oruba*, are about to be added to the Orient Line, and will sail from London for Australia on June 6th and July 4th respectively. These vessels were built by the Naval Construction Co., at Barrow, and are each 5,552 tons register, 7,000 H.P., 450 ft. long, 49 ft. beam, and 37 ft. deep. Accommodation is provided for about 230 saloon passengers (first and second class), besides a large number of third-class passengers. These steamers are provided with music and smoke rooms, &c., on the promenade deck, are fitted throughout with the electric light and electric bells, and are replete with every comfort and accommodation. The *Orotava* will be commanded by Captain G. N. Conlan, late of the *Orizaba*. The *Oruba* will be in charge of Captain J. B. Park, who is also well known in the Australian trade.

AN AMERICAN LINE OF ATLANTIC MAIL STEAMERS.—The United States Senate Committee reports favourably upon the Bill introduced by Senator William P. Frye, of Maine, authorising the Postmaster-General, Mr. John Wannamaker, to contract for 10 years with a line of American steamships intended to carry the European mails. Companies have been formed, and shipbuilders are ready to build the steamers as soon as the contracts are signed. The largest steamers of the contemplated new line will only be 8,000 tons register, but they are all expected to develop great speed. It is also considered possible that the new line of American-built ships will be built under Government supervision, and according to specifications drawn up by the Navy Department, so that they may be converted into fast "commerce destroyers," or cruisers, in case of war.

THE SHIPBUILDING YARDS AT BILBAO.—A Madrid correspondent telegraphs: Sir Charles Palmer and Senor Martinez Rivas have been received in audience at the Palace by Queen Christina, who listened with much interest to details they gave her with regard to the progress made in the Anglo-Spanish naval yards at Bilbao. Queen Christina said she would like to be present at the end of August when the first cruiser built on the banks of the River Nervion will be launched, if state business allows her Majesty to visit Bilbao this summer. It seems that Messrs. Rivas and Palmer assured Senor Sagasta and the Minister of Marine that they hoped to be able to deliver to the Spanish Government the three cruisers now building in their yards at Bilbao at least six months before the stipulated time. Most of the workmen and engineers employed are English.

SHIP'S MODEL.—Messrs. Kelso & Co., Glasgow, well-known as model makers and electricians, and whose ship models have been subjects of admiration in all recent exhibitions where naval architecture has been a feature, have just completed for the Barrow Shipbuilding Co. a magnificent full model, on a scale of ¼in. per foot, representing the Canadian Pacific Royal Mail steamers, three of which are now under way at the Barrow establishment. The model, which is enclosed in a handsome glass case, counterfeits a twin-screw vessel of most graceful design, her fine lines, smart cutwater, and big funnels, carrying the impression of entire capability to attain a speed of 19 knots, for which she has been designed. Her dimensions, as recorded on the name-plate on the model, are:—Length, 485 ft.; breadth, 51 ft.; depth, moulded, 36 ft.; tonnage, 5,700 tons gross. Her engines will indicate 10,000 H.P., and when it is remembered that these will be from the designs and supervising care of so experienced an engineer as Mr. Bryce-Douglas—formerly of the Fairfield Co.—little doubt will be entertained as to the vessel's capabilities for attaining the speed required. She has two funnels, and three short, spare-pole masts, and the ten small boats she carries above her spacious weather deck indicate that large numbers of passengers will be carried. The destined service for these vessels is between Vancouver and Japan and China, but they are to be armed and otherwise adapted for service as reserve cruisers of H.M.'s Navy. The fidelity and beauty with which every item, even of the minutest description, has been represented by the makers, will command admiration.

COMPOSITION FOR SHIPS' DECKS.—It is a matter of some concern to shipowners to know how to prevent corrosion where the decks are of iron or steel. Without a preservative of some kind it is clear that these parts will suffer very materially in a severe voyage, as, for instance, across the Atlantic Ocean in winter. The Holzapfel's Composition Co. have lately put on the market a special paint for this purpose, and from the report of the trial of this article by one of the leading shipowners we are led to infer that something new and valuable has been discovered. The name given to it by the firm is Holzapfel's Special Black Soapstone Composition. It is said to dry in one hour and cover a very large surface, the price being very reasonable. From the standing of the suppliers in this especial branch of manufacture, and the character of the report before us, we deem the matter well worthy of the attention of all those who may be interested.

BRITISH GUNBOATS FOR THE ZAMBESI.—On Saturday, May 10th, a trial trip was made of one of the gunboats which Messrs. Yarrow & Co., of Poplar, are building for the Government service on the Zambesi and Shire Rivers. It being impossible to ship entire gunboats of sufficient size to be of any practical utility, or to navigate to East Africa vessels of a description suitable for river service, a plan has been adopted by which the hull is built in floating sections, each section being of such a size as to render it easy of shipment in a vessel's hold. The class of vessel determined upon by the Admiralty authorities as most suitable is what is known as the stern-wheel type, which proved so successful during the Nile Expedition. The wheel in this case is easily got at for repair in case of accident, and is well protected by the hull from floating obstructions. The dimensions of the steamer are 77 ft. in length by 18 ft. beam, having a draught of 18 in. with steam up and a speed of 12 statute miles an hour. On the main deck are cabins and sleeping accommodation for the chief officer, three petty officers, and eight men, who will form the European crew, in addition to which hammocks will be swung from the upper deck for the accommodation of natives. On the top of the upper deck is placed the pilot tower, from which the steersman can obtain an all-round view. Over this, again, will be provided canvas awnings and side curtains, so that the entire vessel during night or when subject to the heat of the sun will be completely protected. The armament consists of a number of Hotchkiss and Nordenfelt quick-firing guns.

THE JUNIOR ENGINEERING SOCIETY.—At a meeting of this society, held at the Westminster Palace Hotel on the 9th inst., a paper was read by Mr. W. J. Tennant, Grad. Inst. P.A., Chairman, on the Slide-valve and Radial-valve Gears. The author introduced the subject by considering the elementary principles underlying the action of the slide-valve, and thence proceeded to a deduction of the proportions and setting of slide-valves and eccentrics as commonly practised. The effect upon steam-distribution of external and internal laps and leads, and of variations in the setting of the eccentric and proportioning of the ports, was illustrated by a special model, the invention of the author. The Trick, Thom, Brooks, differential, double-ported marine, and other types of flat and piston slide valves were next referred to, and general considerations having reference to reversing and expansion gears were followed by an explanation of a graphical method of determining the speed of a valve or piston at every position in its travel. A demonstration, with the aid of models, diagrams, and lantern slides of the principles and mode of operation of the Hackworth, Marshall, Joy, and Morton radial valve gears, brought the paper to a close. The speakers in the discussion included Messrs. B. H. Joy, Bruce, and Marshall. On the following afternoon, by special arrangements with the authorities, a party of members visited the marine engineering section of the South Kensington Museum, for the purpose of inspecting the collection of models of various types of valve-gears, the construction and action of which were fully explained by the author of the paper, to whom on both occasions a vote of thanks was unanimously accorded for the explicit manner in which he had treated the subject.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from April 21st to May 14th, 1890.

5941 F. J. Adnams, Reading. Raising sunken vessels.
5943 A. S. Moore, Northwich. Casting holes in vessels.
5952 J. Darroch, Newcastle-on-Tyne. Condensing engines.
5991 J. W. Claridge, London. Feeding fuel to furnaces.
5997 W. Newlands and N. Adair, New Cathcart. Reversible steam engine without valve gear.
6013 T. B. Heathorn, London. Apparatus for steering boats.
6031 P. Conway, London. Valves.
6039 H. H. Lake (B. Beck and C. C. L. Hartung, U.S.A.) Rotary steam engines.
6044 W. T. Lord, London. High-speed, &c., engines.
6050 J. S. Morton, London. Propelling vessels.
6055 E. Cockerill & Son and T. Cockerill, Manchester. Preventing smoke in furnaces.
6060 J. D. Churchill, London. Fluid pressure reducing apparatus.
6069 H. Cooper and F. G. Stinchcombe, Bristol. Life-belt.
6085 E. M. Capitaine, London. Aerial navigation.
6092 P. Jensen (S. S. Stont and H. G. Underwood, U.S.A.). Rotary steam engines.
6108 H. Vicars, London. Self-launching ship's refuge.
6112 F. H. White, London. Ships' propellers.
6203 E. C. Sonnet and J. E. Gombanlt, London. Measuring speed of vessels.
6291 F. W. Hayward, Norwich. House and crusing boats.
6307 W. Armstrong, Stockton-on-Tees. Holding gear for ships' boats.
6343 H. Reason, London. Steering toy ships.
6354 P. W. Willans, London. Steam engines.
6379 R. Moverley, Barnsley. Thrust bearings for propeller shafts.
6442 F. S. Pott, London. Towing ship's logs.
6443 F. S. Pott, London. Dividers of compasses.
6474 G. F. Parratt, London. Life rafts.
6517 J. M. Lóvold, Seacombe. Distributing oil over waves.
6558 A. J. Schótt, London. Sea calming apparatus.
6590 J. D. Churchill, London. Governing steam engines.
6593 F. Williamson, London. Lubricators.
6611 C. S. Pocock, London. Mechanical toy boats.
6621 A. B. Brown, Glasgow. Starting, &c., marine engines.
6699 H. J. Simpson, London. Ships' boat disengaging gear.
6711 F. C. Goodall, London. Marine cement.
6741 C. & W. E. Barker, London. Combined pocket sextant, prismatic compass and clinometer.
6815 F. W. Zimer, London. Propelling and managing boats.
6822 W. H. Penligin, London. Ships' davits.
6829 F. A. Adey, Bristol. Combined ships' buoy and signals.
6889 F. Hoyer, Liverpool. Metal plates used in building vessels.
6933 J. Von Peichl, London. Mariners' compasses.
6934 O. Phalp, Cardiff. Sounding of water in ships.
6935 O. Phalp, Cardiff. Boats' rowlocks.
7007 C. Henderson, Glasgow. Boat disengaging gear.
7018 J. Jörgensen, London. Lubrication of shafting, &c.
7061 H. Middleton, Buckingham. War vessels and submergeable ships.
7067 T. W. White, Liverpool. Reducing the pitching of ships at sea.
7091 J. Mnrrie, Glasgow. Steam whistle.
7187 W. C. Church, London. Slide valves for steam engines.
7192 T. Pringle, London. Ships.
7226 W. Thompson, Lenthorpe. Preventing collisions at sea.
7243 H. Aldred, London. Ship-plater's marking reversers.
7291 J. M. Paterson, North Shields. Marine boilers.
7319 J. P. Bayly. (G. Pond, United States.) Buoyant propeller.
7320 J. P. Bayly. (G. Pond, United States.) Buoyant propeller.
7321 J. P. Bayly. (G. Pond, United States.) Buoyant propeller.
7326 H. Skinner & J. B. Chatterton, London. Lubricating position of a ship's helm.
7502 C. J. Memzenmaier, London. Tube cleaners.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

April 26th, 1890.

Aird, Geo. D. ..	1C	Sunderl'd
Armstrong, Wm.	1C	Liverpool
Arthur, A. A. ..	2C	Cardiff
Atkinson, Wm..	2C	Sunderl'd
Barclay, Clifford	2C	Liverpool
Brown, Leonard	1C	N.Shields
Corkhill, John..	1C	Liverpool
Dnmas, Alex. S.	2C	Cardiff
Ewing, Wm......	2C	Hull
Gebbie, John ..	2C	Liverpool
Harvey, Thos. W.	1C	Sunderl'd
Hetherington, W.	2C	,,
Hooker, Francis	1C	Cardiff
Jones, James ..	2C	,,
McLean, Alex...	2C	Aberdeen
Murray, Ogilvie	2C	N.Shields
Paterson, Wm. W.	2C	Cardiff
Purse, Robert ..	2C	Sunderl'd
Rowell, Robert..	2C	N.Shields
Scott, Henry J.	2C	Hull
Shuttleworth, G.	1C	Liverpool
Simpson, John..	2C	Aberdeen
Stanistreet, Sml.	2C	Liverpool
Storry, Walter..	1C	Hull
Taylor, William	1C	Sunderl'd
Trotter, Geo. ..	2C	N.Shields
Turner, Wm. Hy.	2C	Cardiff
Walker, James..	1C	Aberdeen
Wardle, Wm. Jas.	1C	Sunderl'd
Wightman, Alex.	2C	N.Shields
Williams, Thos.	1C	Cardiff
Williams, T. E.	2C	,,
Yonng, Ptrck. A.	1C	Sunderl'd
Stiven, Wm. S.	2C	Glasgow
Swindles, Simeon	1C	Liverpool
Thompson, J. G.	2C	N.Shields
Thompson, S. A.	1C	,,
Thomson, Wm.	2C	Glasgow
Wilkins, R. F...	1C	London
Williams, D. R.	1C	Liverpool
Withell, Martin	1C	London

May 3rd, 1890.

Anderson, Harry	2C	Glasgow
Andrews, Xnophn	1C	Liverpool
Anton, Arthur..	2C	N.Shields
Ash, Alfred E...	2C	Liverpool
Black, Charles..	2C	Glasgow
Cantwell, A. J...	1C	London
Carpenter, Fredk.	2C	N.Shields
Dean, Wm.	2C	Glasgow
Donaldson, Alex.	2C	Glasgow
Donll, Ronald ..	2C	London
Evans, Colin ..	1C	,,
Fettis, Geo. W.	2C	N.Shields
Gardiner, Wm. C.	2C	,,
Girvin, John L.	1C	Glasgow
Grundy, John A.	2C	London
Hall, Charles ..	1C	Liverpool
Kerr, Richard ..	2C	Glasgow
Laing, Thos. B.	2C	N.Shields
Mather, John ..	2C	Glasgow
Mackenzie, H. ..	2C	N.Shields
McColl, John ..	1C	Glasgow
McPherson, A. J.	1C	,,
Owen, Owen	2C	Liverpool
Prowse, James..	1C	Glasgow
Russell, John C.	1C	,,
Scrafton, Thos.	2C	N.Shields
Speedy, John C.	1C	,,
Spiers, Robert..	1C	Glasgow

May 10th, 1890.

Acklam, Henry	2C	Hull
Borthwick, John	1C	Leith
Butterworth, B.	2C	London
Christie, Andrew	1C	Leith
Drinkwater, G. F.	2C	Liverpool
Edwards, Thos.	2C	,,
Hodgson, John H.	2C	Hull
Jamieson, J. L.	2C	Leith
Jeffery, Martin	2C	London
Muir, James ..	1C	Leith
Nicolls, Wm. D.	2C	Liverpool
Russell, John M.	2C	,,
Stewart, Saml. C.	2C	Leith
Taylor, Alex. E.	2C	Liverpool
Wilson, William	1C	Leith

May 17th, 1890.

Adam, James ..	2C	W. Hrtlpl
Avis, Henry	2C	London
Barnes, Chas. H.	2C	,,
Barr, James....	1C	Greenock
Browne, James	1C	Dundee
Campbell, James	1C	Greenock
Carnegie, Chas. E.	2C	N.Shields
Cass, Geo. W. ..	1C	W. Hrtlpl
Christie, Wm. ..	2C	Greenock
Curry, Edington	1C	W. Hrtlpl
Daiziel, Hugh ..	2C	Greenock
Davie, Henry A.	2C	N.Shields
Dixon, Robert ..	2C	,,
Douglas, Hy. B.	2C	,,
Douglas, Wm. B.	2C	Greenock
Fyffe, Jno. G. ..	1C	Dundee
Hobson, Wm. E.	1C	N.Shields
Hudson, John H.	1C	Liverpool
Johnstone, H. L.	1C	Greenock
Johnstone, Thos.	2C	,,
Jones, Frdk. M.	2C	London
Kay, Wm. N. ..	2C	Dundee
Lang, Hugh	1C	Greenock
Macalister, Adam	2C	London
McElwee, Archd.	2C	Greenock
McIntyre, Jno...	2C	,,
Miller, Thos. M.	2C	Dundee
Mnir, Jno.......	1C	N.Shields
Mnlvey, John J.	2C	W. Hrtlpl
Neilson, John R.	2C	Greenock
Peithes, D.	2C	London
Pocock, Harry P.	2C	,,
Richardson, K.	1C	Liverpool
Sole, Arthur G.	2C	London
Sweeney, Wm...	1C	Greenock
Wetherell, C. S.	1C	W. Hrtlpl
Wilson, Donald	2C	Dundee

STEEL SHIPBUILDING.—It is reported that steel shipbuilding on a large scale is going to be carried on upon the American lakes, and that a Cleveland iron company, and a Chicago steel establishment have formed a company to build steel vessels in Chicago. The yards are to be on the east side of the Calumet River in South Chicago, and it is stated that in a few months the company will have six steamers on the stocks.

The Marine Engineer.

LONDON, JULY 1, 1890.

IT is so much the custom to regard the run from Queenstown to New York as the arena upon which the contest of Atlantic record-breaking must be carried on, that it must be somewhat of a surprise to many to find how closely the recent performances of the steamers crossing the Atlantic *via* Southampton have crept up upon the best speeds accomplished by steamers crossing *via* Queenstown. Only two years ago, before the *Lahn*, of the North German Lloyd fleet, began to run from Southampton to New York, the best time between these two ports was as much as 7½ days, which, though good time for Southampton as compared with the performances previously, was yet far behind the best time on the Queenstown route. Thus, in June, 1888, the *Etruria* had made the run from Queenstown to New York in 6 days 1 hour and 47 minutes, and as the passage from Southampton is about 260 knots, or 14 hours (at a speed of 19 knots) longer than the run from Queenstown, a passage equal to the best of the *Etruria* would be equivalent to about 6 days 16 hours. The *Lahn*, as above indicated, first broke the seven days' record between Southampton and New York, and in the course of last summer the *Augusta Victoria*, of the Hamburg-American line, and the *Columbia*, new steamers in their first season, both beat the best time of the *Lahn*, while the *Columbia* made the best passage of the year from Southampton, in 6 days 18 hours 20 minutes. This season the *Columbia*, on her third voyage, has excelled herself with a run of 6 days 16 hours 2 minutes. Deduct 14 hours for the difference between Southampton and Queenstown at that speed, and the run of the *Columbia* is considerably quicker than the best passage made as yet from Queenstown by the White Star liner, *Majestic*, one of the recent competitors, said passage being accomplished in 6 days 2 hours and 25 minutes. It is, moreover, better than the best passages of any other Atlantic steamer except those of the *Etruria* and the *City of Paris*. The best time of this latter vessel was made on her run in August last year, when her time from Queenstown to New York was 5 days 19 hours 18 minutes, equivalent to 6 days 9 hours from Southampton. The *Etruria's* best time was 6 days 1 hour 47 minutes. The *Columbia*, therefore, as the best steamer from Southampton, has seven hours still to lop off in order to bring down the time to the best of the *City of Paris* —unfortunately at present unable to engage in the present season's contest, or to the best of the Belfast-built *Majestic*. Attention is concentrated on the performances of the new Hamburg-American "flyer," the *Normannia*, from the stocks of famous Fairfield, and it is probable, judging from the results of her first voyage, surrounded as it was with disadvantages and mishaps unavoidable, she will prove herself a rival to the *City of Paris* and *Etruria* in their proud position of premier flyers on the Atlantic. Whatever may be the result it will certainly call forth fresh efforts on the part of competing lines. Companies which have not yet given an order for new Atlantic "greyhounds" are understood to be watching the performances of the best vessels this season, with the view of excelling them by means of new vessels embodying all the improvements based upon study and experience.

THE large number of paddle-wheel steamers recently built on the Clyde—most of them for service on that river and its firth—has created much interest in the question as to the progress which has been made in producing speedy paddle steamers. It is maintained by some that little or no advance in speed has been made since 1860—61, in which years several very noteworthy vessels were plying on the river. These were the *Ruby*, *Rothesay Castle*, and *Neptune*, and they were all of about the same size and type: approximately 200 ft. long by 19 ft. beam. Each of these vessels traversed the distance between the Cloch and Cumbrae lights at the rate of about 17½ knots per hour, and the speed was maintained in actual service between Glasgow and Rothesay. It is on record that the *Ruby*, in July, 1861, made the passage from the Isle of Cumbrae to Glasgow in 2½ hours, including three stoppages at piers on the way, being equivalent to an average speed of 22 miles per hour. The fleet of high-speed paddle boats doing service on the Clyde is this season augmented by the *Duchess of Hamilton*, the *Marchioness of Bute*, the *Marchioness of Bredalbane*, the *Adder*, and the *Princess Victoria*—the two last crossing the Channel to Ireland. The *Duchess of Hamilton*, which plies between Ardrossan and the Isle of Arran, is a vessel 250 ft. long and 30 ft. beam, and her reported speed between the Cloch and Cumbrae lights was 18 knots per hour; a slight advance, indeed, from 30 years' experience, when the horse-powers exerted in propelling the older and the modern vessels at their respective speeds of 17½ and 18 knots, and the difference in their lengths, are considered. The greater beam relatively to length in the modern boats is, however, a point upon which the designers may justly lay stress, as affording grounds for considering that matters have not been quite non-progressive. The comfort and luxuriance for passengers implied in this increased beam is also a consideration which should not be overlooked in making comparison of the capabilities of the present-day designers and those of 30 years ago. As to improvement in the agents of propulsion themselves; there is the same apparent non-progression. While compound engines have been introduced in paddle vessels built for service abroad for many years, it is only now that the Clyde, with its world-renowned fleet of river boats, is being traversed by vessels having their engines of the compound type. The old haystack boiler and simple engines have long held the field, because this type of boiler, with all its faults, is still the lightest that is available for marine purposes, and coal being so low in price about the Clyde, the extravagant consumption of fuel by the old-fashioned arrangement is not so great a consideration as that of minimised draught and displacement and higher speed. Five years ago Messrs. Rankin & Blackmore introduced into the steamer *Ozone*, for service abroad, the Admiralty system of forced draught, combined with compound paddle engines, and now, three of the paddle steamers built this year for service on the Clyde have their engines of the compound type by this firm. The performances of these vessels will be watched with keen interest, and the results well weighed by owners of existing steamers having the old machinery. Even with coal-pits so plentifully at hand, it is unlikely that—in new vessels at least—owners and engineers will revert to a type of machinery which—although having well served its day and generation—is yet quite out of keeping with the general standard of modern marine engineering.

IN spite of the great popularity which corrugated furnace-flues have attained in the Navy there still seems, by the records and discussion of the North-East Coast Institute of Engineers and Shipbuilders, a revolution setting against them. This we believe is due almost entirely to the difficulty occasioned by the adherence of scale to corrugated flues, which appears to be much more marked than in the case of plain flues, and also offers considerably more difficulty for its removal. There is little doubt however that the first essential in the construction of boilers (with the present high steam pressure employed) is elasticity between the flues and shell, &c., and is a primary necessity for steady reliable working without leakage. Messrs. Taylor & Kelvington have done their utmost before the said Institute to advance the claims of plain flues of sufficient thickness to resist crushing without corrugation, as being preferable to the corrugated flues, by contending that the greater thinness of plate which may be employed in the corrugated flue has no perceptible advantage in more easy transmission of heat over the thicker plate which must be employed in the plain flue. They therefore advocate the use of plain furnace plates from ¾ to an inch thick. They contend that the conducting powers through the thickness of the plate is normally very much higher than the absorptive and remitting powers of such plates, as has been shown long ago by Peclet. Thus an extra ¼ of an inch of material does not materially affect the speed of transmission of the heat through the plate. Curiously enough there seemed to be no active opposition to this idea among the other members of the Institute, nor did they apparently consider the tendency of a thick plate to burn or overheat more quickly than a thin one, to be sufficiently marked to be a factor of consideration against the employment of thick plates. The most forcible line of objection to plain, straight thick flues was the want of elasticity between the flues and shell, which was admitted on all hands to be a frequent cause of much leakage at the joints. Instances were brought forward in which excess of longitudinal and rigid staying had given endless trouble in the leakage of joints until the staying had been modified. These points were considered to be most essential for a good and reliable boiler for reasonable length of life, and to give the least trouble in repairs during such life, and is not necessarily associated with the corrugation of the flues, except in a sense that it is favourable to such form of construction of the flues. With regard to the known objection of excessive scaling on the corrugated flues, it would surely be more business-like to use one of the preventions (so many of which are known) of the formation of scale, rather than to make a retrograde step in the reduction of elasticity in the flues by going back to plain plates. It is possible that such flues as are known at present by the term "corrugated" exaggerate the value of such construction to elasticity beyond what is really required, and that a diminution of the number of corrugations, as compared with the part of the plate left plain, may suffice to give the elasticity required, whilst at the same time to present a plainer surface than that of the so called corrugated flues. We should think it perfectly possible that the deposition in scaling so much complained of could by suitable arrangements be entirely prevented, which would be better than discarding an excellent furnace by reason of an accessory evil or drawback. It would appear that many of those present had experienced great trouble in straining and leaking by reason of the steam being raised too rapidly when required, this will obviously tend to produce abnormal results in straining and leaking, as the fires must be forced and the consequent temperature of the flue is exaggerated, as compared with the temperature of the water and outer shell.

ON all hands it is now recognised that the exceptional activity which characterised the shipbuilding industry up to the close of last year has, for the present, at any rate, completely passed away. The first half of this year has now run its course, and the absence of new orders during the past six months has been in striking contrast to the previous pressure of work in every shipyard throughout the country. The cessation of new work coming forward in the shipbuilding industry has been accompanied by an even more complete collapse in the iron and the steel trades, and there is little doubt that the one has re-acted upon the other. Extraordinary activity in shipbuilding and the large requirements which it represented for all descriptions of material in manufactured iron and steel, no doubt to some extent stimulated the disastrous speculative operations in the markets, which not only forced up prices far above what was legitimately warranted by actual trade, but assisted the workmen in demands for unjustifiable advances in wages, with a result that the cost of production was raised to a point so abnormally high as to check altogether the further placing out of new work. As is always the result in a market with prices unduly inflated by what is neither more or less than purely speculative gambling, the reaction has been sudden and severe, and the collapse has been perhaps one of the most remarkable recorded in the annals of trade. The question is now being eagerly asked, What is to be the outcome in the future? Has trade itself also altogether collapsed for the time, or is the present cessation of new work coming forward only a temporary check from which it will recover when it is seen that prices have again become settled on a healthy and legitimate basis? If substantial reductions in the price of all descriptions of material were all that were requisite to ensure the revival of trade, they would now certainly seem to have returned to a sufficiently low point to encourage hopeful anticipations for the future. In raw material, such as pig iron and hematites, prices have fallen according to brand, at least 40 to 50 per cent., whilst in manufactured material which is required for shipbuilding, taking steel plates as an item of perhaps one of the greatest importance, prices have fallen from £9 10s., at which actual business was done in steel ship plates no longer than six months ago, to £7 2s. 6d. per ton as the quoted price of to-day, with sellers at even considerably below this greatly reduced figure. Whilst in steel plates for boiler-making purposes, in the place of £11 15s. which was being got at the commencement of the present year, the leading makers are now willing to accept £8 2s. 6d., and sellers in some instances are prepared to book orders at even 5s. per ton below this figure. These prices represent reductions in mere material, which, as we have said, if this alone were necessary to ensure a return of trade, would seem to be amply sufficient. It is, however, not only on the cost of material that the recovery of trade is mainly dependent. Wages have risen to so high a point that this has become a much more serious element whenever labour enters at all largely into the cost of production. In shipbuilding yards the advance from the lowest point which was being paid during the times of depression has been from 40 to 50 per cent., whilst in the marine engineering shops direct advances in most departments have amounted to 25 per cent., in addition to which increased allowance for overtime and other matters have represented a further increase, making the advance not less than 30 per cent. Any substantial relief in this direction would seem to be more than doubtful without either a severe and disastrous struggle between capital and labour, or the equally disastrous process of reducing the workmen to terms of submission by a protracted stagnation of trade. That some rectification in wages is, however, an absolute necessity is only too obvious. Raw material cannot itself be placed upon the market at the prices at which it is now being offered, except at a considerable loss to the producer, with the rates of wages that are now being paid to the workmen. One of two things must therefore follow, either the wages must be reduced, or the production of material itself must cease until the prices in the market can be raised, or the cost of producing it can be reduced. On the other hand, users of the raw material are unable to secure new work even at the unremunerative prices at which it is now obtainable, as they are also handicapped with high rates of wages which render it impossible for them to secure orders except at unremunerative terms. The only means of escape out of the present difficulties would therefore seem to be that wages must follow the decline in the value of the materials which labour has to produce. No doubt the workmen's organisations will resist as long as possible any concessions upon what they have been enabled to secure during the recent spurt of activity, but that they will be compelled to submit to the inevitable is a question which can be open to very little doubt. Some of them have recently been parading their great increase of membership during the past twelve months as an indication of increasing strength, but with declining trade and decreasing employment this may be found one of their sources of weakness, as their largely-increased membership will mean largely-increased demands upon their funds for the support of members who must necessarily be thrown out of work. During the previous period of depression, the support of unemployed members was an enormous drain upon their funds, and threatened to seriously cripple their resources. With a largely increased membership these demands in a recurring period of depression will necessarily be felt to a proportionately increased extent, and the prospect therefore is that although the trades' union organisations may threaten a strenuous resistance to any reduction in wages, their resources will scarcely be sufficient to enable them to carry out a general or long sustained struggle.

THE ACCIDENT TO THE "CITY OF PARIS."

On June 16th, 17th, 18th, 19th, and 24th an inquiry instituted by the Board of Trade was held at St. George's Hall, Liverpool, into the circumstances attending the breakdown of the low-pressure starboard engine of the Inman and International Steamship Company's steamer *City of Paris*, when on a voyage from New York to Liverpool on March 25th last. Mr. Raffles, stipendiary magistrate, assisted by Captain J. T. Bragg, Captain W. Eames, and Mr. J. H. Hallett, C.E., assessors, constituted the Court. Mr. Mansell Jones and Mr. Howard Smith, instructed by Mr. Walter Murton, appeared on behalf of the Board of Trade; Sir Walter Phillimore, Q C., and Mr. Baden Powell, instructed by Messrs. Hill, Dickinson & Co., for the owners of the *City of Paris;* and Mr. Pickford, instructed by Messrs. Bateson & Co., for Messrs. J. and G. Thomson & Co., the builders of the vessel.

Mr. Mansell Jones opened the case on behalf of the Board of Trade. He said that the accident, which formed the subject matter of the inquiry, was almost an unprecedented one in the annals of steamships. The *City of Paris* was built by Messrs. J. and G. Thomson, on the Clyde, in 1889. She was a very large vessel, being 527 feet in length, with a breadth of 63 feet, and a depth of 22 feet. She had two sets of triple-expansion engines, of 2,000 indicated horse power, but working up to about 16,000. Her registered tonnage was 5,580 tons, and she was registered at Liverpool. She was commanded by Captain Frederick Watkins. She had performed a few voyages in 1889 to New York and back, and in January this year was repaired in dry dock, certain defects having been found in connection with the engine-room. She was built under survey of Lloyd's and the Board of Trade from the very commencement until the time she obtained her passenger certificate, which was not granted until the Board of Trade officials had come round with her from Glasgow to judge of her capabilities. In January last, it was found that the after bearing of the starboard shaft was worn down about half an inch. This was repaired. Flaws were also detected in the columns of the engine-room casting, flaws caused by the shrinkage of the metal in cooling. These were strengthened by steel plates screwed in, and he believed it would be found that these were found intact after the accident. She had altogether 14 bulkheads. Under the Merchant Shipping Act, 1854, the Board of Trade had power to say what partitions there should be in steam engines; that section was repeated in 1862. Curiously enough—showing the slips apt to be made in Acts of Parliament—the word "partition" appeared in the 1862 Act, but it was clearly surplusage. The bulkheads were numbered, that at the bow being No. 1. [Plans showing the construction of the ship were put in.] The compartments to which particular attention would be called were Nos. 9 to 12—9 of the engine-room. This had a longitudinal bulkhead, so that the starboard and port engines had distinct and separate rooms. There was a watertight door between the after end of each engine-room and the dynamo-room, and two from the dynamo-room into each shaft tunnel. There was also a door in the fore and aft bulkhead, between the engine-rooms on the first platform, almost in the centre of the engine-room. The doors named were worked by hand from the upper deck; all other doors were worked by hydraulic machinery from the engine-room, but if that machinery became impaired, the doors could work automatically and remain closed. The ship was rigged as a three-masted schooner, and carried 11,025 square feet of canvas. After the repairs named, the *City of Paris* made a voyage to New York and back and out again to New York, and it was on returning that she met with the accident which necessitated this inquiry. She left on the 19th March, with 687 passengers and a crew of 373 hands. The crew was very strong in the engine-room department, where there were 176 persons, being divided as follows:—Chief engineer, 18 assistan's (of whom 6 had chiefs' certificates), 3 electricians, 3 refrigerator men, 3 donkeymen, 3 storekeepers, 33 greasers, 54 firemen, 57 trimmers, and 1 clerk. All went well to the 23rd March, when the starboard engine was stopped at 10 minutes to 9 to repack the high-pressure piston-rod. That occurred about 10 minutes to 9 o'clock, and the engine was started again at 10 minutes past 10 that morning. The engines were apparently working all right from that time until the afternoon of the 25th. She was on that day at noon in lat. 51 10 N. and long. 15 23 W. At 5.20 that afternoon the engine-room watch was relieved, and Mr. Gill, the third engineer, Mr. Gibson and Mr. Woolcroft, also engineers, took charge. The engines were then working at about 81 to 82 revolutions. Mr. W. Gill went into the starboard engine-room and felt the crank-pins of that engine, and he found them all right. He then went to the port engine-room and heard the starboard engine suddenly race for some two or three seconds. He rushed back to the engine and adjusted it on its centre, and then went back to the port engine, but as soon as he got through the door of the engine-room, in the partition, he heard a tremendous crash, and something came through the iron bulkhead, making a considerable hole. He rushed back again and found the starboard engine-room a perfect wreck. He would be able to produce some photographs of the condition she was found in when she came back, and he understood it would be a very convenient thing if the members of the Court could visit the vessel and inspect the *debris*. He presumed the engine-room was cleared by this time, but the *debris* was there. There was a greaser, named Cunningham, who said that he was swabbing the rod to the low-pressure cylinder, and stooped down to clear the valve cover, when the cylinder cover blew up, and the steam rushed out and scalded him. The man was present, and would be examined. The moment after the catastrophe happened the whole place was enveloped in steam. The chief engineer, in his office above, heard a great noise and rushed down to the engine-room, but could not get into it on account of the steam. He then went down into the stokehole, where he met the three engineers in charge, and then he had the doors closed, and after some short time managed to get into the engine-room and did his best to stop the connections with the sea, many of which were broken. The water when he got there was, he thought, 6 ft. high in the starboard engine-room, and was rising so that certain cocks could not be got at. The carpenter sounded and found 2 feet of water in No. 10; in the dynamo-room there were 10 feet, and it continued to rise until it was level with the water in the engine-room, which rose to no less than 25 feet; and in consequence of the hole knocked in the bulkhead between the two engine-rooms a great deal of water got into the port engine-room, which was finally flooded with water as well. The pumps were rigged and kept down the water in No. 11 and No. 12 compartments. An attempt to stop the hole in the bulkhead between the two engine-rooms by beds and other appliances was unsuccessful, and an attempt by means of a sail to stop the entrance of water into the vessel through the pipes was also ineffectual. The water rising to a height of 25 feet in the engine-room, the forward bulkhead began to "buckle," but, observing this, the engineer shored up the bulkhead with wood, and it did not give way. The efforts of those on board were much favoured by the weather, which was calm, though there was a long roll of the sea. All sail that was practicable was set on the vessel, but there was no wind, and though the crew were successful in keeping the water under the ship lay rolling about without any means of progression. The chief officer went away in the lifeboat into the track of vessels, and the vessel drifted until the morning of the 28th, when the chief officer fell in with the *Aldersgate*, which came and took the *City of Paris* in tow, and landed her at Queenstown on March 30th, at 4 in the morning. By that time the continued pumping had cleared out No. 11 hold and reduced the water in No. 12 to seven feet, but the engine-room had 25 feet of water in it, and the crew were unable to cope with that. At Queenstown divers were employed, and by their aid all the injection and discharge pipes in the vessel's side were plugged, and the water was pumped out of the vessel. The steamer left Queenstown on the night of the 2nd of April, and arrived at Liverpool the next evening, where she was docked. Counsel then gave in detail the results of the examination of the engine-room of the *City of Paris*. The low-pressure engine was found to be a complete wreck, the condenser, the cylinder, cylinder cover, piston columns, and air pump all being broken into an enormous number of pieces. The main shaft had lifted about five inches, and the caps of the bearings in the tunnel were broken off. In closing his remarks, counsel reminded the Court that the vessel was built under survey of Lloyd's and the Board of Trade, and certain recommendations made by the Board of Trade were adopted most readily, he believed, by the owners. Those suggestions had no doubt enabled the water to be kept under on the occasion in question. He must also remind the Court that the accident happened under peculiarly favourable circumstances, owing to the fine weather. The utmost energy was shown by all the officers and crew, and providentially it was successful in saving the ship; but at the same time he must call attention to the fact that the accident might have occurred under very different circumstances.

The breakage and utter destruction of the engine might have taken place in very bad weather indeed. He apprehended the Court would consider and report, not merely as to whether the vessel was built according to the specifications, of the best material, and under Lloyd's and the Board of Trade surveyors, but that they would take into view all the facts of the case, and say whether all the precautions were satisfactory and sufficient to protect the splendid vessel and the enormous number of lives on board. The Board of Trade asked the assistance of the Court in coming to a conclusion as to the cause of the accident, whether every precantion was adopted, or whether any precaution might have been taken by anybody. Mr. Mansell Jones then suggested that the Court should proceed to inspect the vessel.

Sir W. Phillimore said the owners were most anxions to give every assistance, and he would be glad if his friend would give in a little more detail what the suggestions were that he had alluded to.

Mr. Mansell Jones said it was for the suggestions to come from the Court.

Sir W. Phillimore.—I thought my friend had something in his own mind.

Mr. Mansell Jones.—Nothing in the world. Mr. Jones added that not only was the vessel built under special survey and subjected to a somewhat severe ordeal before receiving her passenger certificate, but she was also built as an Admiralty cruiser.

Sir W. Phillimore.—She passed the Admiralty requirements.

The Court then adjourned to inspect the vessel.

On the second day, Mr. H. Wilding, examined by Mr. Howard Smith, stated that he was managing agent for Richardson, Spence & Co., the owners of the *City of Paris*. The specification produced was drawn up by the owners and agreed to by the builders. This vessel was built to Lloyd's requirements of the highest class.

Sir Walter Phillimore.—I understand not.

Mr. Raffles.—We shall see by-and-by.

Witness.—She was built to Lloyd's highest requirements so as to obtain a passenger certificate. The specification for the machinery was drawn up by the builders and discussed by the owners. Substantially the ship was built according to these specifications. She passed Lloyd's surveyors. The builders had the option as to the material to be used—it was a question between iron and steel. They used steel generally. The material of the columns was left to the builders, and they were built of cast-steel.

By Mr. Pickford.—The material was left to the option of the builders, subject to the approval of the Board of Trade and Lloyd's.

James Thomson, examined by Mr. Mansell Jones, said he was a member of the firm of James & George Thomson, the engineers and constructors of this vessel. The specification produced was that by which the ship was built, with the exception of some small matters. In addition, the builders were to submit to the Admiralty such drawings and specifications as were required to fit the vessel to be an armed cruiser, and to have fittings for guns. The boilers were of steel. The shafting is of steel throughout, and is hollow, the diameter of the hole being 3¼ in. The crank shaft was in three interchangeable pieces, each length being 11 ft. 6 in. long by 20¼ in. in diameter. The thrust shaft is 16 ft. 9 in. long by 19¼ in. in diameter, the diameter between the collars being 29¼ in. There are three lengths of tunnel shafting, each 22 ft. 9 in. long by 19¼ in. diameter. The stern shafting is 44 ft. 6 in. long. All the shafts are made of a special steel by Vickers, of Sheffield, and the lengths are joined by flanges and bolts. The shaft (outside?) would weigh 23 or 24 tons altogether. There was no bearing upon that particular part of the shaft. The main bearings were of cast-iron, lined with white metal. The thrust block bearings were of cast-steel, lined with white metal. The tunnel blocks were of cast-iron, also lined with white metal. Lignumvitæ was used in the bearings, fitted in strips close together, and they were kept in position by brass keeps, and were secured in the usual manner. There were 14 transverse bulkheads extending to the upper deck, and the thickness was 7-20ths below and 6-20ths above the lower deck. The plates were worked vertically, and there were stiffeners 30 in. apart. He had seen one bulkhead which was in the same condition as when it left the shipyard, as far as he could see. There were no doors between the engine-room and the boilers. When the ship was built a plate was left out, but afterwards riveted in its place.

Sir Walter Phillimore.—That would be for convenience in building.

Witness.—The bulkhead was further stiffened by horizontal "Z" bars, 7 in. by 3½ in. The same construction applied to all the bulkheads. The boiler-rooms communicated by means of watertight doors, all being about 8 ft. above the keel. The doors were opened by means of hydraulic power, and they were self-closing. There was a door that closed from the main deck. There was a door between the two engines. The columns were made of steel, and tested in the usual way. He did not think the testing was prescribed for by the specification. The columns were hammered and thrown down. Some of the columns developed cracks afterwards. He had never seen this before in columns of this size. He had seen steel plates put over the cracks. The cracks were due to the contraction of the metal in cooling. He had not cast so large columns before in steel. His attention had been called to one column which had been strengthened by steel plates. He did not see that any strain had been put upon it. He saw where the bush had been worn six or seven inches. The bearings should be examined at every favourable opportunity. He could not attribute the wearing to any particular cause. Some lignumvitæ might be harder than others. The lignumvitæ was held in place by means of a ring. There was no play allowed between the ring and the lignumvitæ. The wood would not absorb much water. He had no theory as to the cause of the bush wearing in the way that it had done. The shafts were tested at the works in Sheffield, and they were inspected when delivered. The cylinders of the engines were made of cast-iron. They were triple-expansion compound engines. The length of stroke was 5 ft., and the working parts were exact counterparts of each other. The maximum number of revolutions per minute was 90. The piston rods were 10 in. in diameter. The crank shafts were made of Vickers' steel. He did not think any governors would stop the engines under the circumstances.

Cross-examined by Sir Walter Phillimore.—This was a swift vessel, and intended to be such. There was no sacrifice made of strength for speed. There were numbers of things done to make the ship more safe. Safety was the first consideration. There were twelve lines of horizontal plate stiffening connected with the shell; she had web frames throughout. The specification was substantially adhered to; the variations, such as they were, were of the nature of improvements. Originally the specification was for six boilers, but nine boilers were put in The transverse bulkheads were up to Lloyd's requirements. The engine-room bulkhead was stiffened by an ask hoist, and also by a longitudinal bulkhead, which divided the two engine-rooms. On the longitudinal bulkhead there were two platforms, all giving additional strength to it. He had not seen any indications of that bulkhead giving way. Even supposing that bulkhead had given way, the ship would have had ample freeboard. The piece of the shaft where the fracture was weighed abont 23 tons, and beyond that was the tail shaft, which was bolted to the previous piece. The tail shaft was supported by an aftermost bracket. With respect to the cracks which he had described as heat cracks, he fonnd no mischief in them as long as they were put right by plates, as was done in this case. The same bearings were used in the Royal Navy, and it was only a matter of expense that they had not been used in the merchant service. They had a very substantial guarantee that the columns were tested. The injury to the ship was caused by the wearing away of the lignumvitæ and the bush and the shaft itself, so that the whole drop was six or seven inches. Lignumvitæ was the most suitable wood for the purpose. If the vessel travelled 20 knots with a twin screw, she would go 16 knots with one screw.

Sir Walter Phillimore said there was no hostile criticism offered, and he had a difficulty in dealing with this witness, who was the builder of the ship, and he wanted to know whether there was anything in Mr. Jones's mind, so that he might meet it, and, if he had nothing to say, the cross-examination need not be continned.

Mr. Jones said he had helped the witness, and felt that he had examined him as if he were appearing for him.

Mr. Raffles said his experience was that every confidence was shown in such cases.

Mr. Jones said the object of the Board of Trade was to put every fact before the court.

Mr. Raffles.—To get at the truth.

Mr. Jones.—And to seek the assistance of the court to find ont anything that would cause this accident. He had gone into the construction of the vessel, and had asked the gentleman if he had any theory, and he said no. A very extraordinary occurrence had taken place, and it was the wish of the Board of Trade to get at the whole truth.

Mr. Pickford said he did not propose to ask any qnestion now, but if anything arose he would ask to recall the witness.

Mr. Jones said Mr. Pickford would have a perfect right to do that.

By the Court.—Witness said the bush might wear very fast, or it might take a considerable time. He could not say how many of the columns had been repaired, but he thought there were five.

Capt. Bragg.—How far were the web frames apart?

Witness.—I think about 12 ft.

Capt. Bragg.—Had the vessel valves that cut off the opening of the injection pipes to the sea?

Witness.—Yes.

Capt. Eames.—Did you see the fragments of the metal casing or liner?

Witness.—I did.

Capt. Eames.—Did you observe that they were of various thicknesses?

Witness.—I did.

Capt. Eames.—Did that not appear very singular, and did it occur to you what might be the cause of it?

Witness.—No; I could assign no cause.

Capt. Eames.—It is presumed the metal ought to have been of uniform thickness?

Witness.—Yes; that is the intention.

Capt. Eames.—Did you see the casing when it was examined in January last?

Witness.—No.

Capt. Eames.—Now, as regards the columns, the weakness exists, so far as we were able to judge yesterday, in exactly the same place. Don't you think the columns should be strengthened in that place before using?

Witness.—It would be difficult to discover the exact place.

An affidavit was then read by Mr. Howard Smith from Mr. Doran, who had been the superintendent engineer of the company, and had now gone to America. He stated that the specification for the ship was fully and satisfactorily carried out in all respects, and the whole of the material and workmanship was of the best description, and the ship was built under close inspection. The ship had not been examined since January last, because she had not been in graving dock.

Mr. James Mollison, Lloyd's surveyor, stated that he had inspected the engines of the *City of Paris* during their construction, and up to their final trial on coming round to Liverpool. He tested the steel castings by hammering, &c. There was no special rule for examining steel castings, but he had found this plan satisfactory. If he had occasion to find fault he did so. He had inspected the supports of the propeller shaft from the engine to the screw and the various bearings. In his opinion the shaft was sufficiently supported. He did not require any more than there were. There was no rule as to the bearings or their distance apart. There was generally a support to each length of shafting, and there was a wide difference in the practice on the Clyde, ranging from 10 to 16 diameter. The appearance was that of a cup and ball fracture. The shaft had been gradually going, and then snapped suddenly. The shaft had gone down six in., and as from the point it had broken to the centre of the propeller was fifty feet, it was clear there had been an enormous strain put upon that portion of the shaft, with the whole leverage of that overhanging weight. The wearing of the bush had been going on for some time previous to the breaking. He had examined the bush and the fragments of brass lining, and it was evident they were very much worn before they left the shaft. It had worn all round. These were the first steel columns that he had seen except in Admiralty ships. There were no openings to admit foreign matter into the shaft. He had seen the way in which the cracks in the columns had been repaired, and he was of opinion that the strength had been maintained, since the part repaired had not given way at all. With regard to the lignumvitæ he thought it did not swell much.

Cross-examined by Sir Walter Phillimore.—The fracture was not where the crack was repaired: it was some outside injury which broke the column. He saw the gun metal liner put on the shaft. It was true when put on, and of even thickness. The wearing of the liner was brought about by rubbing against the other metal. The liner would wear against the steel, and then it would be steel to steel. Substantially both the gun metals had disappeared as well as the lignumvitæ, with the result that there was a drop of about six inches, including the wear of the shaft. That appeared to have caused the shaft to break. The strain must have been something enormous. He had no doubt it was the shaft breaking which produced the mischief in the engine-room. The wear and tear must have been going on for some time before the final catastrophe.

Mr. W. T. Coutier Dutton, examined by Mr. Howard Smith. He stated that he was shipwright surveyor to Lloyd's Register. He had surveyed the *City of Paris* from time to time during her construction. The ship was built according to the committee's requirements, as furnished to him. He had tested the bulkheads with water, and the test was entirely satisfactory. He had also tested the castings with a satisfactory result, and he passed the ship.

By Counsel.—It is correct to say that her safety was not sacrificed to her speed? Yes, nothing was sacrificed, and nothing but the best material was used.—Did you on any occasion exercise your right to reject anything? Yes, in the smaller details, but in important points he had no recollection of having had to reject anything.

By Capt. Bragg.—Then you say you considered this a tight, strong, staunch, and seaworthy vessel in every respect, and that the metal used was of the very best? Yes, I do.

Mr. James Stewart, Board of Trade surveyor at Glasgow, said he inspected the machinery of the *City of Paris* during her construction, and he came round with her to Liverpool, and gave a certificate. Both construction and material were first-class. He had not the slightest hesitation in granting a passenger certificate after seeing the manner in which the ship worked coming round from Glasgow to Liverpool.

By Mr. Baden-Powell.—In his opinion cast steel was a proper material to use in the engines of the vessel. He thought there were sufficient supports for the shaft as it lay in the ship. He considered that brass or gun metal was proper material for the liners, and he noticed that the liner fitted to the after end of the shaft was a capital job. The hammering test when applied to the columns did not suggest anything wrong with them. He had seen the cracks since, and he considered they might possibly have been there when the columns were cast.

Mr. Geo. Elliott, principal officer of the Board of Trade at Glasgow, stated that he in conjunction with Mr. Stewart inspected the *City of Paris*, and he was thoroughly satisfied with the construction of the vessel, and upon that he made his report and declaration. The engines worked admirably.

Mr. Wm. Heron, principal foreman engineer at Messrs. Laird's yard, Birkenhead, said the vessel was overhauled at the public graving docks in January last. He examined the bush and the starboard bracket. There was a wearing down of about 7·16ths of an inch. He examined the shaft and liner, and the whole of the casing was taken down. He could not examine the whole of the liner, because the shaft was not taken from the bush. He raised the shaft till it touched the top of the lignumvitæ. He found a space of 7·16ths of an inch, and allowing for ⅛ of an inch, this showed the lignumvitæ had worn down 5·16ths of an inch. After consulting the company's engineer and the ship's engineer, it was decided that the bottom half of the lignumvitæ should be removed and renewed. (The witness described in detail the manner in which the lignumvitæ was removed and renewed.) Special care was taken in the selection of the lignumvitæ, but the length of the strips—6 feet—was unusual. Lignumvitæ was a very oily wood, but he could not account for its wearing down in this case. If the shaft was not running true it might do it, but there was nothing to suggest that the shaft was not running true. The shaft and bush were not removed, because he (witness) considered he could make a good job of it without removal. He had orders to do it regardless of expense, and in his opinion it would not have been a better job if it had been removed.

Mr. James Henry Thomson, shipwright surveyor to the Board of Trade, said he was at Birkenhead in January last, when the *City of Paris* was in the graving dock, and he examined her. The ship had made nine or ten voyages. He was satisfied with the way in which the bush was repaired, although he made some objection at first. The bush ought to have been taken out. He knew he would see the ship again in two months' time, so he withdrew his objection.

Mr. James Ramsay, senior Board of Trade surveyor, said he inspected the vessel for the purpose of looking at the plates fitted to the columns for the purpose of strengthening them, and in his opinion the desired object was attained. The deflection in the shaft was sufficient to break it. He could not attribute any cause for the wearing of the bush. If the shaft were out of truth, that would do it. He could give no opinion on steel castings at present. After the shaft broke the engines ran with increased speed; stresses were set up owing to the change of velocity, and the top of the piston would strike the cylinder cover. He had no opinion as to what gave way first. If the engines were running at an enormous velocity, the bolts would stretch, and the strain upon the connecting rod bolts would be subjected to a tensile stress of 20 tons to the square inch, and that would be sufficient to stretch them out like a piece of indiarubber. There are no sufficiently distinct marks to show that the piston came up and struck the cover. When the cylinder cover of the low-pressure cylinder broke, the other two engines kept up and knocked the piston rod all to pieces. There were plenty of indications of that to be seen. As to the condenser, he thought a piece of the cylinder must have struck it.

By Sir W. Phillimore.—There were two other boats he had given certificates for which had steel columns.

Mr. J. Wall, chief engineer of the *City of Paris*, said he had been nine trips in her as chief, and he was senior engineer in January when she was docked. She was docked for an annual overhaul. The engines were in good condition from an engineer's point of view. Three columns developed cracks, and one was repaired in New York.

Mr. Mansell Jones said he would recall this witness, and, with the view of giving a chronological history, call now the engineer in charge at the time.

Mr. John Gill said he was third engineer on board the *City of Paris*, but he held a certificate as first-class engineer. At twenty minutes past five o'clock on the 25th March he relieved Mr. Wright. The engines were running at from 81 to 82 revolutions per minute. The weather was fine and the sea smooth. The vessel was not rolling then. There was a pressure on the steam gauge of about 140lbs. He felt the crank pin brasses, and they were all right. That was a few minutes before the accident. He went into the port engine-room and fastened the door behind him. When he got through he heard the starboard engine make a sudden race, followed by a crushing, grinding noise. He rushed back into the starboard engine-room and got the reversing handle to the mid position, as near as he could judge by the steam. Large pieces of iron were flying down on the plates close to where he was. He jumped back into the port engine-room and went aft, and as he was passing aft there was a heavy fall against the bulkhead. Then directly after that there was another heavy fall, and then all was still. He saw the cylinder down, and there was a large volume of water coming down from the back of the starboard engine. The chief engineer ordered the doors to be shut. The water came into the port engine-room through the broken bulkhead, and the ship fell into the trough of the sea and rolled about. He remained in the port engine-room until he was driven out, about midnight. The lights were extinguished, and the pumps were put to work.

By Mr. Baden-Powell.—The engine-room became full of steam afterwards. The pieces of iron were flying all around him, and he was in considerable danger when shutting off the steam. This was on the lowest platform.

On the third day, Andrew Gibson, fifth engineer, holding a certificate of competency as second engineer, was examined by Mr. Howard Smith, said that on March 25th it was his watch in the engine-room from noon until 4 o'clock. During that time the engines were working well at 146 lb. to 148 lb. pressure. He was relieved at 4 o'clock, and about 20 minutes past 5 he went into the engine-room again to relieve Mr. M'Laren. He went round the starboard engines to feel the bearings. The engines were still working very well, the steam gauge at that time registering 146 lb. He went through the door into the port engine-room, and felt the bearings of the port engine, which were all right, and whilst doing this he heard the starboard engines suddenly race. As he was going to see what was the matter, something came through the bulkhead past his head. He could not tell what it was. He looked into the starboard engine-room and saw the low-pressure cylinder of the starboard engine falling, and other material from the engine flying about. The lights had gone out, but there was no steam at that time, and no water that he could see. He rushed back to the port engine-room, and at once heard a tremendous crash in the starboard engine-room. He then went up for lamps, the lights in the port engine-room having also gone, and, having got lamps and lighted them, he went down again to the port engine-room and assisted to shut the watertight bulkhead door between the engine-rooms. He also assisted in closing the doors communicating with the dynamo-room. They succeeded in closing the doors, and tried to block up the holes which had been made in the bulkhead. There was no water in the port engine-room when he went up for the lamps, but when he came down it was rushing through the door in great volume, and was up to his knees, and by the time the door was closed it had risen up to his chest. It took them five or six minutes to close the door.

James Aldcroft, senior fifth engineer, said he went into the starboard engine-room about a quarter-past 5 o'clock. He went to the after end of the condenser and was tasting some condensed water when he heard the engine race, and he came to the conclusion that the propeller had gone. He ran round the back of the engine, and had taken about three strides when he heard a loud crashing noise. He was then at the back of the intermediate engine in the starboard engine-room. All the lights went out, and the engine-room was instantly filled with steam, and he got a good wetting from the water coming from the condenser and through the hawser holes. He went up the ladder in the starboard engine-room to get lamps, and came down the port ladder. He assisted in closing the bulkhead door. There was no difficulty in closing it, and he did not think it took longer to close it than undre ordinary circumstances. He also helped to close the dynamo door, and afterwards, by order of the engineer, shut the port injection valve.

David Cunningham, a greaser, whose watch it was in the starboard engine-room from 4 to 8 o'clock on the evening of the accident, said he was swabbing the tail rod of the low-pressure cylinder and had stooped down to clean the valve cover, when something like the piston came up and struck the cover, which flew up, and the steam rushed out and scalded him. He did not notice whether the engines were racing or not before the cover was knocked off. He threw himself down to escape from the steam and from the iron which was flying about, and groped his way to the ladder. Just as he got on to the ladder he heard a heavy crash, apparently as of the cylinder falling. On reaching the deck he went to the steward to get his arm, which was scalded, dressed.

John Walls, chief engineer, recalled and examined by Mr. Mansell Jones, said that at the time of the catastrophe he was in his office on deck, on the starboard side, close to the ladder leading to the engine-room. His attention was attracted by a great noise and vibration in the engine-room. He jumped off his seat and tried to get down the starboard ladder, but was met by a volume of steam. He ran along the deck and got down the firemen's entrance to the main deck. He ran along the firemen's passage to the engine-room, to which there was an entrance by a hinged door. He met three engineers there, and gave them orders to get down to the stokeholes and shut the stop valves—one engineer to each stokehole. When he reached the engine-room entrance by the hinged door he found the room was still full of steam. There were four or five engineers standing in the passage, and, remarking to them that something had got to be done to get the steam cleared away, he jumped on to the platform where the double-beat valve was, and, with the assistance of some of the engineers who followed him, managed to get it closed. The effect of closing that was to shut off the steam from the starboard engine. After closing it he ran down the ladder to the port engine-room, and met there the second engineer, Mr. Carnegie, who told him that the starboard engine had collapsed. He told Mr. Carnegie to take charge of shutting the doors, and gave another engineer, Mr. Macgregor, orders to go round and open the bilge injections of the port engines. He himself took several engineers and tried to shut some of the sea connections in the starboard engine-room. He saw one of the engineers shut the discharge valve, but he found afterwards that the pipe between the valves and the ship's side had been damaged, and the shutting of this valve, though it stopped the big inrush of water, did not stop it effectually. The water rose very rapidly. About five minutes afterwards, Mr. Carnegie reported to him that the doors were all shut, and that everything had worked admirably, but that there was a big lot of water running into the port engine-room through the fractured bulkhead. Attempts were made to stop the entrance of the water by means of beds and other appliances; but they were ineffectual, and the water gained until they were forced out of the engine-room. All the available pumps were got to work, and when the vessel arrived at Queenstown the water had been reduced 12 feet in No 12 compartment, and 6 or 7 feet in No 11 compartment. The engine crew worked splendid: he had not the slightest murmur to make about them. When he examined the machinery in the dock at Birkenhead he could form no opinion as to what had gone first. The very things he would have expected to go first were intact. After the propeller fell off he examined the shaft, and came to the conclusion that the fracture had occurred at sea. The primary cause of the fracture was the wearing down of the bush. The liner on the shaft burst. It would then open out and wear down the lignum vitæ until it came metal to metal, when the steel would soon be worn down. He had not been able to trace the cause of the bursting of the liner. It was possibly owing to a flaw in the material, or to its being too tight. It had not burst before the repairs in January, or he must have seen it. Previous to January the lignum vitæ part of the bush had worn down 5-16ths of an inch. That was a large amount of wearing down in the time, but not an unusual amount. Seeing that the port bush had not worn down at all, he came to the conclusion that the wearing down of the starboard bush was owing to difference of material, or perhaps to there not being enough water circulating through. The shaft had never been taken out of the ship. He saw the bush repaired in January. It was done under his supervision. To all appearance the shaft ran true afterwards. If it had run slightly untrue, that would wear away the lignum vitæ.

Do you think it would have been a better job to have taken the screw off and the bush out altogether in January? We took the screw off to do the job as we did it; but, being a bracket so far away from any other obstruction, I considered that we could make as good a job in that way as by taking the bush out. After the job was finished, we examined it and came to the conclusion that it was a perfect job.

Cross-examined by Sir Walter Phillimore: The work was not done in the way it was for the purpose of saving time. There was no reason for hurry. The vessel was undergoing her annual overhaul. She went into dock on the 6th January, and came out on the 18th, and she was not due to sail until the 5th February; so that there was no hurry. He thought the way in which the damage was repaired was as good as any that could be adopted. A quarter of an hour before the accident he took some saloon passengers down to see the engines at work, and they were working excellently then. The shaft made no hole in the skin of the ship. There was a slight damage to the double bottom, but it did not touch the skin. He considered the columns strong enough, after the plates had been put upon them, to support the engines.

By Mr. Pickford: He was with the vessel on her first voyage in 1889, and from her running then, and from his examination in 1890, he was satisfied that the liner was in a proper condition, and true and properly on the shaft then. He was at first under the impression that the damage in the engine-room was owing to some defect in the engine itself, but he had come to the conclusion that the shaft broke first and caused the damage. All the bulkhead doors were closed within five minutes after the accident.

By the Court.—He thought the shaft was sufficiently supported.

James Carnegie, the senior second engineer, was called. He said he had a certificate of competency as first-class engineer. He was in his room when the accident took place. The first thing that attracted attention was an increase in the speed of the engine at about a quarter-past 5 in the afternoon. He left his room and tried to get into the starboard engine-room by a door leading from the alley-way to the engineers' rooms on the main deck. He could not get by that door through the steam. He afterwards went to the upper deck, and met Cunningham, the greaser, coming from the engine-room. He went down the starboard ladder and found Mr. Walls, the chief engineer, getting the double-beat valve shut. He looked through the grating of the low-pressure engine, and he saw it lying at the bottom. He then went to the starboard engine-room, and found the water up to the platform. The chief engineer told him to get the doors shut, while he got as many of the valves shut as he could. Witness told other engineers to get the dynamo doors shut, which could be done in two or three minutes. He found afterwards that the doors had been shut. He discovered the holes in the bulkhead from which the water poured down upon him. Mr. Walls told him to get these holes stopped, and he went for the carpenter and cut some timber, and worked at the holes till they could stay no longer. They succeeded in stopping the holes, but not effectually. Unless the liner burst he could not see what could have caused the accident.

John R. Wright, third engineer, said there was nothing amiss at 4 o'clock. The shaft had never been taken out to his knowledge. He heard the engine racing, and felt a vibration at the time of the accident.

Robert M'Laren, fourth engineer, said he was in the engine-room at 5 o'clock, and he heard no noise or anything to lead him to think anything had gone wrong. He heard the engine start to race afterwards, and then a crushing noise.

G. Moffat, carpenter, said that after the accident he helped to close the watertight doors from the upper deck. He sounded the water in the ship several times, and found it increasing, but on March 26th it was gradually reduced.

Captain Watkins, master of the *City of Paris*, said there was a crew on the ship of 375, 687 passengers, and a full cargo, including 2,000 bales of cotton. They had fore-and-aft sails, which amounted to over 11,000 ft. of canvas. There were no square sails on board. All went well to the day of the disaster, when he noticed the engines commenced to race. Directly afterwards he felt the ship vibrate, and he heard a crushing sound, although indistinctly. He went to see the chief engineer. He agreed as to what the engineers had done. With regard to the position of the ship, she would be, he thought, 286 miles from Queenstown, at noon on March 25th. The speed was 19½, or perhaps 20. When the accident happened the ship would be about 176 miles from Queenstown. The vessel fell into the trough of the sea when the engines stopped. No sail was got on the vessel at that time, but he thought sails were set next day, and the wind sprung up a little, but the sails had no effect upon her. The wind remained light until they got to Queenstown. They were in the usual course of vessels at the time. He did not sight any vessel during that evening or the next day. Sail would steady the ship and keep her head to wind and sea; but that was not sufficient. There were three masts, and sails could be set on each. He had had experience on steamers fully rigged, but large steamers had no sailing powers, and he did not consider it advisable for them to have—not twin-screw steamers—because the sails would have to be so large that they would not be able to handle them. When he found that the ship was drifting a little to the north, he sent the chief officer to go and find a steamer. He went to the Fastnet, but the ship was picked up before he returned. A steamer called the *Aldersgate*, from London, came to her at daylight on the morning of the 28th, about 113 miles west of the Fastnet, and she successfully towed them to Queenstown, where they arrived at 4 o'clock on the morning of the 30th.

Cross-examined by Sir W. Phillimore.—The crew, as well as the passengers, behaved very well indeed. The *City of Paris* was 10,499 tons gross and 5,581 tons net. They had plenty of boats to carry all the souls on board. They had 26 boats, most of which were lifeboats. Without being unnecessarily alarmed he took the proper precaution of getting the boats ready, and water and provisions, as well as blankets for the passengers. Before picking up with the *Aldersgate* they drifted a considerable distance towards Ireland—an average of 30 miles a day. They came to Liverpool with their own port screw, without any assistance, and had it not been for the unfortunate accident which made holes in the bulkhead, they could have steamed very well with the port engine to Queenstown, without less than a day's delay. The ship *Ohio* called to the *Aldersgate*, and she made a claim in the Admiralty Court and got £600 and the *Aldersgate* £7,500. Mr. Justice Butt expressed a very favourable opinion of the ship. The mean draught of the ship coming from New York was only 8½ inches more than when they left the dock at New York. The water was not sufficient to make her unmanageable.

Frederick M. Passow, chief officer, said he had charge of the boat which went for assistance, and he met the *Adriatic* outward-bound for New York. He asked the captain to take the *City of Paris* in tow, but the captain said he could not do so, his instructions being only to perform salvage services for the purpose of saving life. Witness asked him to go and consult Captain Watkins, and proceeding towards land, was picked up by a Spanish steamer and landed on the coast of Ireland. The *Adriatic* sent on the *Aldersgate*.

Peter Sampson, principal assistant to the engineer surveyor-in-chief of the Board of Trade, said he had made an inspection of the *City of Paris* in dock. He saw no signs of straining on the shaft after the casing was taken down. With regard to the repairs in January, he thought they were able to make a sufficiently good job without taking out the shaft. The only advantage of taking it out would have been to enable them to more closely inspect the brass liners.

Sir Walter Phillimore said he understood that this concluded the case for the Board of Trade, and it would be a great convenience to Sir Edward Reed if the Court would take his evidence before his learned friend put the questions for the Court's consideration.

No objection being made,

Sir Edward James Reed, M.P., was called and examined by Sir Walter Phillimore. He said he had examined the specifications of the hull and machinery, the drawings of the bulkheads, machinery, shafting and supports, and also the *City of Paris* herself. He had examined her very carefully with regard to the question of safety, and he found in the design a great many evidences of special consideration—of the special adaptation of the structure of the ship to the service she was to perform. The system of framing was one assisting to give that rigidity to the ship which was so desirable in a vessel of extremely fine lines, to be driven with great engine power at a very high speed. The structure beneath the bed-plate of the machinery was novel to a large extent, and well calculated to give strength and security to the vessel. The bulkhead that separated the engine-room from the boiler-room afforded a remarkable instance of numerous subsidiary parts of the structure being brought in to the support and strengthening of that bulkhead. He considered that that bulkhead was amply sufficient for its requirements. With regard to the employment of cast steel for columns he thoroughly approved of it, supposing the steel to be properly manufactured and annealed. It was proper material for the purpose, and was widely used in her Majesty's Navy, and in foreign navies, and witness had himself used it in the columns of an ironclad quite recently. With regard to the bearings, he quite agreed that, as to the inboard ones, the shaft was amply and sufficiently supported. He could not say that he thought the ship wanted additional outboard bearings. Outboard bearings were viewed with disfavour. The bracket of the fractured shaft showed no sign of straining. Some of the evidence before the Court had gone to show that after the relining of the bush with lignum vitæ, the shaft and bearings were examined, and it was found that at both ends the relation of the shaft to the bearing was what it ought to be, showing that there was no great straining or warping of the shaft from the wear. It was proved that the shaft on the opposite side had no evidence of wearing, and only a moderate amount of wearing on the starboard shaft gave no reason to suppose that it had suffered from that cause. Such an accident as a split liner had happened in his experience, and he did not think it a very uncommon accident. Very little extra friction, arising from some temporary foulness of water, would very soon change the condition of the brass liner—probably cause it to split, and if that were split the whole thing would be easily accounted for. Judging from the evidence he had heard, however, he did not think there could have been anything the matter with the liner in January. A flaw in a liner was a thing that came on not gradually but suddenly.

By the Court.—The system of bush here adopted was that generally adopted. It was largely adopted on the Clyde and by the Admiralty. He should always insist on the champering being sufficient to allow of a free circulation of water.

By Sir Walter Phillimore.—Lignum vitæ had been found to be by far the most satisfactory material for bearings. A clearance was always allowed with a view to slight shrinkage. There should always be a free access of water to a lignum vitæ bearing. The wearing down of 5-16ths of an inch of a bearing was not very excessive. He had taken the opportunity of comparing the hull and machinery of the *City of Paris* with a recently-constructed ironclad—not with engines of the same power certainly—and he was surprised to find that in every particular in regard to which the comparison was made—the strength of the bulkheads and so forth—the steamer was fully up to the Admiralty design.

By Mr. Mansell Jones.—Some "foul" must have started the mischief in the wearing down of the bush.

On the fourth day Mr. Mansell Jones read the questions for the court, as follow :—

The Board of Trade desire the opinion of the court upon the following questions :—1. Whether in the construction of the vessel, her engines, and machinery, full provision was made to ensure her safety as an ocean-going steamer, and whether in any, and if so, in what respects the safety of the vessel was sacrificed to speed? 2. Is cast steel a proper and suitable material to be employed in the columns, bedplate, and boxes of the bearings of the shaft and all or either of the portions of the machinery? 3. Was the shaft of the starboard engine properly and sufficiently supported throughout by bearings? was the after bracket properly constructed, and was it of sufficient strength, having regard to the length of the shafting and the propeller it had to support? 4. Were the bushes in the stern tube and after bracket of suitable materials and of proper construction? 5. Were the shaft liners properly constructed, were they of suitable material, and were they properly fitted to the shaft? 6. Were the cylinders, piston rods, connecting rods, and all other parts of the machinery of the starboard engines of suitable material, was the material properly examined and tested, and were the starboard engines properly constructed? 7. Whether suitable governors were provided? 8. Were the bulkheads properly constructed, and were they of sufficient strength independently of support from either shoring or cargo for the purpose of insuring the safety of the vessel assuming any two of the cargo compartments flooded at the same time in any state of weather? whether the longitudinal bulkhead between the engine-rooms was of sufficient strength and carried to a sufficient height, and was it desirable that there should be a door in it below the water line? 9. Having regard to the fact that this vessel had two engines entirely independent of each other, was the sail power sufficient? 10. What was the cause of the cracks which developed in the columns, and were they efficiently repaired? 11. What was the cause of the lignum vitæ in the bush in the starboard bracket wearing down about 5-16ths of an inch, and was it properly and sufficiently relined and made good in January last? 12. Having regard to the wearing down of the lignum vitæ in the bush, was it sufficiently examined thereafter? 13. Was it possible either by observation or sound to have discovered when the engines were working that the after bearing of the propeller shaft was worn down? 14. What was the cause of the casualty? 15. What was the cause of the water finding its way into the engine-room and other compartments? 16. Was the bulkhead forward of the engine-room weakened by cutting away the lower portions of two of the stiffeners? did it leak or bulge after the casualty, and was the shoring necessary in order to insure its safety? 17. Would it be desirable in future that the large sea connections should be capable of being closed from the main or upper deck? 18. Have the court any suggestions or observations to offer which, in their opinion, might tend to obviate casualties of a similar nature in the future.

Mr. Geo. Hepburn, C.E., was then called and examined by Sir W. Phillimore. He said he was a naval architect and engineer, carrying on business in Liverpool for the last 24 years, and had a large experience in the construction and repair of steamships. His first connection with this matter was being consulted by the owners of the *Aldersgate* in regard to salvage. He surveyed the latter ship as well as the *City of Paris*. He had also further inspected the *City of Paris*, and in his opinion she was a good steamship, fitted for an ocean-going passenger ship. He considered her as fine a vessel as he ever saw for the purpose. Although she was a swift ship he saw no indication of safety being sacrificed to speed. He had no personal experience of the use of cast steel for columns, but it was used for many other purposes, and it was used in the Royal Navy. It was more expensive than iron. He thought the cast steel would be equal to anything that ordinarily could be put upon it. This ship would stand the strain of her engines as well as an ordinary ship with small engines. There was not the slightest strain observable in any part of her. He did not think any ordinary ship would have kept afloat under the circumstances brought about by this accident, because the engine-rooms were full of water. He had had experience of liners splitting and lignum vitæ being cut out and taken clean away. These had been cases where the brass lining had been of good quality, and had run a considerable time before they did split. It was a nice piece of work to put on the lining, because it must be put on hot and solid, but not too tight. If too tight it might hold for a time, but would afterwards split when it got worn enough. This was a matter which no care or skill could guard against. He had had experience of different kinds of bushes. The bushes used in this ship were generally used on the North-East Coast—in the Clyde and in Liverpool. The bulkheads of this ship were very strong. He did not know that he had seen any stronger. The engine bulkhead showed no signs of straining. The columns with the plates were strong, and they did not break where the plates were. The materials of the engines, &c., were good. The port engine was a fine engine.

Cross-examined by Mr. Mansell Jones.—He had seen the remains of the shaft. The liner was worn, but the three inches at the after end were not. In his opinion the cause of the wearing was the splitting of the lining. The wearing took place in the part hanging in the bracket, and about three inches remained intact, except that the after end had split.

By the Court.—The brass lining was of good material. It was not usual to put governors on marine engines except in rough weather to keep them from racing.

Mr. Benjamin Martell said he was chief surveyor of Lloyd's Register, and was most intimately acquainted with the construction of the *City of Paris*, and from what he had seen of the ship and the specification, he did not think anything had been sacrificed to speed. The vessel was built especially to realise great speed, and in order to provide for this and to meet the additional strain, there was a whole series of web frames placed entirely throughout the ship to counteract the additional vibration which would be caused by the working of the engines. The recommendations made by Lloyd's were complied with by the builders. The ship was constructed beyond the ordinary requirements. She was specially constructed, and generally speaking she was the finest ship he ever saw. The bulkhead at the engine-room was unusually strong, and he calculated that it would withstand 2½ times the water pressure put against it at 22 feet. The outboard bearing and bracket were very substantial. An intermediate bearing would not have prevented the accident. Large naval ships were fitted practically the same. With regard to sails, he believed the time was coming when such ships would not carry any sails. Such masts and sails would be required that a large number of men would be required to work them. He considered the shaft was sufficiently supported, though an intermediate outboard bearing would have taken a certain amount of the pressure off.

Mr. John H. Byles, naval architect, and now manager of the Southampton Naval Works, said he had a large share in designing the *City of Paris* when he was with Messrs. Thomson. He had never built a finer ship. Lloyd's had no requirements for this extraordinary size of vessel. It had to be considered on the merits of the case. She was specially considered by Lloyd's people in he fullest detail, and they were satisfied with the construction as t went on, and every suggestion that they made was carried out. Nothing was sacrificed to speed. In a fine ship they put in greater strength in parts than they would in other ships. The bulkhead at the engine-room was sufficient to stand the strain. The holes in the plate would not materially weaken it. He thought it was stronger than it was with the stiffener uncut. After the accident he inspected the bulkhead of the engine-room, but he did not find any signs of straining. No ship could be constructed to stand the wreckage of machinery. He thought cast steel was admirably adapted for the columns, and that the shaft was sufficiently supported by the outboard bearing. The bush was one generally used on the Clyde and other places. Sail power in such a ship was not as necessary as in a single screw ship. In twin-screw ships they were giving up sails entirely.

Cross-examined by Mr. Jones.—Taking the advantages and disadvantages, he thought it was not desirable to have masts and sails in twin-screw ships. Bulging in a bulkhead was the commencement of doing the work for which a bulkhead was designed, to resist the pressure of the water. The bulkheads in pretroleum ships were not stronger than those in the *City of Paris*. It was not practical to test the bulkheads in the ship. Petroleum ship tanks were tested for carrying the oil. There was danger in having compartments pumped by the engines, as was shown in this case. They should be pumped by manual labour. His opinion had been overruled by the Board of Trade. (Laughter.) The designs which he made, and which were placed before the Board of Trade, might have included this pumping by the engines, but he had had some conversations with the surveyor to the Board of Trade.

By the Court.—He thought the shaft having dropped six inches showed that the bearing was sufficient. One never could tell what would have happened if there had been another bearer there. Another bearer would only have had the effect of putting back the time of the accident, and they would not have had an opportunity of making repairs without docking the vessel for the purpose. An intermediate bearing was not necessary. Under some circumstances it might have been of use. If they continued arguing as to bearings they would have a long stretch of them all the way along.

By Mr. Jones.—The door between the engine-rooms was necessary to control the flow of water from one side of the engine-room to the other.

Mr. Edmund Taylor said he was a partner in the firm of Richardson, Spence & Co., managing agents for the Inman and International Steamship Co. He produced amongst other certificates of inspection one by the American authorities for this ship as a passenger ship. Although the firm owned a considerable number of ships, they never had dealings with Messrs. Thomson & Co., builders, before they contracted with them to build the *City of Paris*, and the twin ship *City of New York*. He knew they were a firm that had a reputation, and had built for the Cunard Co., and had constructed English and foreign men-of-war. Their reputation was of the highest character. The *City of Paris* was built particularly for safety, and with the best quality of materials. He had been most unquestionably satisfied with the work of the builders in both ships. It was a practice to lay up each of these ships for a month each year for an overhaul in January. This ship had ample time for that purpose, and there was no question of haste in doing anything. She had 17 days after leaving the dock. There was no necessity for haste in replacing the lignum vitæ in the bush.

Cross-examined by Mr. Jones.—The American certificate was necessary before they could take passengers from that country, and it had to be exhibited on board the ship.

Sir Frederick Bramwell, past president of the Institute of Civil Engineers and of the Institute of Mechanical Engineers, member of the Naval Architect Institute, and one of the vice-presidents and fellow of the Royal Society, gave evidence as to the introduction to science of the present form of screw. He had examined the *City of Paris*, and the sister ship, and with regard to the machinery he had not been able to detect the slightest evidence of any sacrifice of safety to speed. The application of cast steel to the bedplates was justified, because it was better than the alternative metal cast-iron, and as regarded the columns cast steel was also preferable, provided, as in the Admiralty, the metal was good, properly proportioned, and annealed. From the castings in the columns he saw the cracks were due to the strain on the metal when ooling; the metal was put into a state of tension, [illegible] that afterwards developed into a crack, and he had [illegible] etal going that way spontaneously. Very often when the [illegible] occurred the tension was relieved, and the casting came to a state of rest, so that when repaired it very seldom cracked again elsewhere. In this case the breakage did not take place where the cracks occurred. He had given his attention to the outboard shaft on the starboard engine, and he was of opinion that an intermediate bearing would have been not only useless, but to a certain extent absolutely dangerous. Sir Frederick then proceeded to justify this assertion on the ground that, allowing for the resistance of the water, there would only be 80 lbs. per inch weight on the lignum vitæ—a thoroughly light load. Although not absolutely balanced, the shaft was fairly balanced, and there was no indication whatever of the want of a bearing in the metal. Then there was a great difficulty in keeping numerous bearings in the one line, and these submerged bearings were inaccessible, and it was altogether undesirable that such should be multiplied. The suggested bearing would have gone to pieces at once. He did not think the lignum vitæ had worn too much, considering the vessel had travelled 60,000 miles. The bulkheads were strongly constructed. The shaft had become bent, and every revolution bent it back and forward until it broke. There was a strain of some 800 tons upon it. The caps were broken, and the shaft lifted. He could not attribute the wearing of the shaft to anything. It was purely a matter of speculation. He should think the whole thing was done in a very short time. He did not think it would have been brought about by the shaft being slightly out of truth. He did not give much credence to the ash theory, and as for the hole in the outer casing, a great number of ships had naked outbore shafts.

By Capt. Eames.—He did not in any way agree with the suggestion for an intermediate bearing. The principal part of the weight came on the afterpart of the stern tube, and therefore an intermediate outbore bearing would not have been the slightest use. The breakage was absolutely abnormal, and no one knew how it had taken place. It was entirely wrong to alter engineering methods for the purpose of dealing with an abnormal occurrence.

By Captain Bragg.—The fracture was caused by an abnormal racking strain at a point just aft the stern tube.

This concluded the evidence on behalf of the owners.

Mr. Pickford said he had been provided with several witnesses to show the good quality of the brass and steel, but the evidence of the witnesses from the Board of Trade and Lloyd's surveyors was so unanimous that unless the court wished it he would not call them. There was also the evidence of one or two shipbuilders of standing as to the sufficiency of the bulkheads, and these he would not propose to call unless desired by the court, because it seemed to him the evidence was all one way in reference to that.

The court intimated that it was unnecessary to call such further evidence, and the witnesses were not produced.

Sir W. Phillimore then proceeded to address the court on behalf of the owners. He spoke of the importance of the inquiry, and said the remarkable nature of the accident had made the ship almost a target for criticism at the hands of the public and the scientific world; but she had come out of that inquiry uninjured and almost intact. She had been built not only with every regard to comfort and luxury, but with every regard to the safety of the passengers, as well as for the speed with which they were to be conveyed across the Atlantic. She had gone through what few steamers would have survived, and the crew and the engineers had behaved in a manner to be proud of. Sir Walter then proceeded to deal with the evidence.

Mr. Pickford said practically his case was the same as that of Sir Walter Phillimore, but the builders thought it right they should be made parties to the inquiry, and offer to the court every possible information and assistance they could. Nothing had been shown against which care and skill could have provided. Special attention had been given to the ship by the Board of Trade, as she was to be an armed cruiser, and she had been specially looked after by Lloyd's people.

Mr. Mansel Jones, replying for the Board of Trade, dwelt chiefly on the question as to whether the shaft of the starboard engine was properly and sufficiently supported throughout by bearings and after bracket, and as to whether the rods were of proper material; also, as to whether the columns were of proper material.

Judgment of the Court.

Mr. Raffles, after recounting the leading facts proved in evidence, delivered the judgment of the court on the questions submitted by the Board of Trade, as follows:—1. We are of opinion that full provision was made to ensure her safety as an ocean-going steamer, and that the safety of the vessel was not sacrificed to speed. 2. We consider cast steel to be a proper and suitable material to be employed generally in the construction of various parts of engines that have been hitherto usually made of cast-iron. 3. The in-board portions of the propeller shaft of the starboard engine are amply supported, and, judging from the present condition of the out-board portions of the propeller shaft of the port engine, the support to the outboard portions of the propeller shaft of the starboard engine, which are of similar construction to those of the port one, would appear to have been sufficient. The after bracket in each case is properly constructed and is of sufficient strength for the shafting and propeller it had to support. 4. The bushes in the stern tubes and after brackets are of suitable materials. The construction, that is the method of securing the lignum vitæ in the stern tubes, is somewhat recent and is said to be much used by Clyde and other engineers with satisfactory results. It is, however, to be observed that in the older and more generally adopted system of fitting—that is, by placing each strip of lignum vitæ in a suitably formed recess, having gun-metal partitions between them, each strip is thus preserved in position, and the waterways between them are larger and less liable to choke. 5. The liners, or casings, were of suitable material, and the evidence we have heard proves that they were properly constructed and fitted to the ship. 6. The cylinders, piston rods, connecting rods, and other parts of the machinery of the starboard engines were generally of suitable materials, and the engines were properly constructed. The materials were tested in the usual manner, to the satisfaction of the surveyors of the Board of the Trade and of Lloyd's. 7. Governors were provided for controlling the engines in a seaway. They were not connected when the accident of the 23rd March occurred, and if they had been they could not have affected the results of it. 8. The bulkheads were properly constructed, and, from our personal inspection of the ship and from the evidence that has been given respecting them, we are of opinion that they were sufficiently strong without shoring or cargo to stem the pressure that they may have been subjected to, assuming any two of the large compartments to be flooded at the same time, in any state of the weather. 9. The longitudinal bulkhead between the engine-rooms is of sufficient strength, and carried sufficiently high. It is desirable that there should be a door in it below the water-line, but it is also desirable that this door should be placed as high in the bulkhead as is consistent with the purposes for which it is required, as was the case in this instance. 10. We consider that the sail power was sufficient. 11. The cracks developed in the cast steel columns of the engine were, in our opinion, caused by the contraction in cooling, which is greater in steel castings than in many other metals, and which, in consequence of the necessary structural arrangements of these castings, sets up considerable tension in some parts. The cracks, in fine, of the columns of the engine were repaired by steel plates, secured in a very efficient and workmanlike manner. 12. We have no evidence that would enable us to express an opinion as to the cause of the lignum vitæ in the bush of the starboard bracket wearing down about 5-16ths of an inch as it appeared when examined in dock in January last. We have evidence as to the manner in which it was relined, and we have no reason to suppose that it was not properly effected, but looking to the fact that the lignum vitæ in the bush of the port bracket had shown an inappreciable amount of wear at that time, it would have been more satisfactory to have withdrawn the tail shaft so as to have relined the bush either in its place or in the workshop. The condition of the gun metal casing or liner on the tail shaft would then have been exposed to a thorough inspection, and if a defect existed it would, in all probability, have been discovered. 13. Having regard to the statement that this ship was to be docked within two months, in accordance with the requirements of the Board of Trade, we are of opinion that the opportunity that would have thus been afforded for further examination would have been sufficient. 14. It was not possible to discover by observation, when the engines were running at sea, that the after bearing of the propeller shaft had worn down, but we would observe that when a propeller becomes loose on its shaft or the propeller shaft becomes loose in its bearings, it generally gives unmistakable notice of its condition (by sound) to those who may happen to be in any near proximity to that portion of the ship to which it is attached. 15. We are of opinion that the primary cause of the casualty was the extraordinary wearing down of the bearing of the bracket which supported the extreme end of the propeller shaft, by which the end had dropped from its original and proper position about seven inches; that this bearing down of the after end, its distance (about 50 ft.) from its nearest support in the stern tube, coupled with the weight of the propeller and of the shaft itself, produced a bending effect on the shaft at its forward support, co-existent with each revolution of the engine; that this had probably produced rupture of the external surface, which gradually extended inwardly, and finally to total fracture of the shaft; that the engine, being thus relieved from all resistance beyond the friction of its own moving parts, would almost instantaneously have acquired a greatly accelerated velocity, the result of which was probably sufficient, by the additional strains on the various connections, to diminish the clearance allowed between the piston and cylinder cover of the low pressure engine at the top end of its stroke; that the cover was struck by the piston and moved off, the piston probably broken up in the act, the cylinder torn asunder, the condenser seriously broken, and the destruction of the various other parts rapidly accomplished. As to the cause of the wearing down of the after-bearing of the propeller shaft considerable difference of opinion appeared to exist. This wearing was of an abnormal character and of unfrequent occurrence. Generally it may be said to have been attributed to two distinct causes, one being that the gun-metal casing or lining of the shaft had burst through, being in a state of excessive tension; the other cause suggested was that ashes, which had been more frequently thrown overboard on the starboard side than on the port, had got into the bearing and set up the action that led to this wear. But there is scarcely a steamship running whose outer shaft bearings are not subject to the conditions that may be supposed to arise through ashes or other *debris* from the ship. What seems to have occurred is, that from some cause or other the waterways in the lignum vitæ strips became choked or were insufficient for the passage of water; that the friction which was generated soon destroyed the lignum vitæ; that the metal casing of the shaft and the bush being brought in contact, heat was further developed sufficient to break up the metal casing of the shaft, the fragments of which were found in the outer protecting case of the shaft presenting the appearance of metal that had been broken while hot; and that the high temperature of the rubbing surfaces of the shaft and its bearing caused the extraordinary wear that followed. 16. One cause of the water finding its way into the engine-rooms and other compartments was that in the break-up of the engine a large proportion of the low pressure cylinder fell or was driven against the condenser, tearing away a considerable portion of its body—tube plates and tubes—and thereby opening a large communication with the sea; through this opening the water rushed in such volume that before any of the inlets to circulating pumps could be closed they became covered by the water and out of reach. Water also passed in through the sea connections of the auxiliary condenser, and, as previously described, the water passed into the port engine-room through the dynamo-room bulkhead doors, the injured bulkhead of this compartment, and through the apertures broken through the middle line bulkhead by the ruptured machinery, and at No. 10 by the injury to the bulkhead of that compartment, into Nos. 11 and 12 by serious injury to the valve-box of the pumps in the engine-room which were in connection with those compartments. 17. We do not consider that the cutting away of a lower portion of a stiffener on each side of the forward bulkhead of the engine-room materially weakened it, as the apertures cut were made good by substantial plate doors bolted thereto. The bulkhead, it was stated, did not leak; some slight bulging was said to have shown, but we do not consider that shoring would have been necessary to ensure its safety. 18. We certainly consider it desirable that suitable means should be provided by which the main sea connections, such as inlets and discharges for the circulating water of the condensers and the main steam stop valves of the engines, could be closed from some convenient position on the main deck exterior to the engine-rooms. 19. It will be readily understood that after the practically unanimous testimony of eminent authorities of the Board of Trade, and of Lloyd's surveyors, the various experts who have been called during this inquiry, as to the strength, completeness and efficiency in all respects of this ship for the service for which she was especially designed and constructed, the court does not consider itself in a position to offer many suggestions or observations thereon. We may observe that during the course of this inquiry we had evidence that even if some of the forward compartments of this ship had been filled with water in addition to those already filled aft she would still have had a fair amount of freeboard, and have been able to float under the circumstances, her mean draught of water on arrival at Queenstown being only 8 or 9 inches more than when she left New York. We are of opinion, having regard to the trying ordeal through which she passed, that she has proved herself to be one of the finest and safest vessels in the mercantile marine. The court would suggest that it is very desirable a really efficient and trustworthy governor of the most approved form should be fitted to each engine and driven by the main shaft. It should be connected by suitable means to the main steam valve and such other valves as may be directly affected in controlling the speed of the engines, and it should never be disconnected from the engines or thrown out of action while they were running. Such a fitting would obviate, if not entirely prevent, a serious casualty in case of shaft fracture or engines racing from any other cause. The court has been informed that only the bulkheads of the extreme forward and extreme after compartments of this ship had been tested with water pressure, and that this is the usual practice. The court would however suggest the desirability of all so-called watertight bulkheads being tested with water up to a certain height, say the orlop deck, not by filling the compartments with water, as appeared to be in the minds of some of the witnesses, nor even to test the strength of the bulkheads, but to test their watertightness, and we are of opinion that this could be effected without much inconvenience or additional expense by the use of a hose-jet, and by running water up to the height mentioned. With reference to the supports for the out-board outward lengths of propeller shafting in large and fast ships generally, it is not intended to make any observations of an adverse character on that provided in the *City of Paris*, which was, no doubt, sufficient so long as the after bearing continued in a normal condition; but, in view of the considerably increased length of these shafts in recently-constructed fast ships, and the possibility—happily, very unusual—of a similar wearing down of the end of the bearing, and from which there is no immunity, fracture of the shaft, with corresponding destruction of the engines and its consequences, would in all probability take place. The court would therefore suggest that this is a question of sufficient importance to deserve the careful consideration of naval architects and engineers. The court would suggest the desirability of isolating each watertight compartment from others as far as possible; but, having regard to the convenience and advantage of steam-pumping power as compared with manual, the court is of opinion that where it is applied to the various compartments in the ship by connections with pumps in the engine-rooms, suitable means should be provided for closing and opening these connections from the main deck. Before closing our remarks on this case the court desires to refer to the admirable manner in which the captain and deck officers, the chief engineer and his assistants, and the crew generally performed their duties and conducted themselves in the trying position they were placed in after this casualty. The court is of opinion that this was in a great measure the cause of the calmness and confidence exhibited by the passengers, and of their general praiseworthy conduct under circumstances not devoid of peril. And further, the court wishes to say that during this inquiry they have received every assistance from all parties concerned to arrive at the conclusion embodied in this report.

Owing to great pressure on our space this month the continuation of "The Spontaneous Ignition of Coal Cargoes," and also several other important articles, have been unavoidably held over till next month.

ANDREWS' CONCENTRIC WIRING AND FIRE RISKS.

THE system of electric light wiring in steamships as at present in use is somewhat wanting in safety from light extinction and risk from fire, and with the view of improving this state of matters, Mr. J. D. F. Andrews, of Messrs. Andrews & Co., Parliament Street, London, has for some years past introduced concentric wiring into interiors, and whenever possible has continued to develop the accessories to his system.

Mr. Andrews recently read a paper on this subject before the Philosophical Society of Glasgow, and from that paper we quote some of his remarks. He says:—" The causes of fires in electric wires may be classed under three headings—the short-circuit, the partial short-circuit, and the opening circuit. An excellent provision against the dangers of the short-circuit is found in the fuse or cut-out, and it is only in case this appliance is badly constructed, or has been tampered with, and consequently must fail to act, that the short circuit need be considered. In the case of a partial short-circuit the increase of the current is generally insufficient to melt the fuse, and in such an instance this protector (the fuse) has been found to be a source of danger, for, although it may not melt, it may become so hot as to ignite inflammable substances that come against it. This may take place even if the fuse is constructed on the most approved lines, because of the long duration of partial short-circuits and consequent accumulation of heat in the fuse. The partial short-circuits themselves are often very curious and interesting developments. The most common form is a general leakage from one wire to the other through damp wood casing over a long length. If this continues the casing is liable to become charred at the best conducting place, and begin to glow and flame. Many curious instances of this kind have been known, and we will describe one peculiar instance that occurred on an Atlantic liner. The casing was saturated with moisture for a length of about 6 yards, but the course the electricity preferred was a diagonal line about 18 in. from one wire to the other, along which the wood was deeply charred. This suggests the theory that wood conducts better with the grain than against it. Under the heading of open circuits come all those faults where the conductor carrying the current gets ruptured, and an arc or bad conducting bridge is established across the break. These are generally the result of moisture on the wires, in a similar way as partial short-circuits are. The wire at the attacked place gradually thins until it is incapable of carrying the current without heating. The casing thereby becomes charred, and by the time the wire is corroded through there is a bad conducting bridge prepared over the charred wood by which the current passes, setting the wood aglow and gradually increasing the breach in the wire. The length of charred wood through which the current will pass in this way has been known to reach 10 in. to 12 in.

"Electrolysis also plays a part in producing opening circuits. The writer was shown a length of wire taken from a ship installation, with copper deposited near one end that had obviously been removed electrolytically from a point near the other end, where it was reduced in thickness. This wire had been taken from a wood casing in which salt water had continually lodged in a length of about 8 ft. Opening circuits, in the case of small wires, are also produced by the wood casing drying and contracting and breaking the conductor, generally at the joints. The twisting of ships and vibration and settling of buildings have been known to cause the same fault. The opening circuit has probably caused more fires than any other fault, and it is the most difficult of all faults to provide against."

It is necessary to make the advantages of Mr. Andrews' system understood to quote so much of his paper, and it will be obvious that in order to avoid fire producing fault in electric light wires, the casing that would harbour moisture must be abandoned, the strength of the conductors must be increased in their tensile strength, and means must be provided for automatically detecting faults. These conditions Mr. Andrews claims to have fulfilled by his concentric wiring.

The construction of Mr. Andrews' wire consists of a core of vulcanised indiarubber, insulated copper wire protected by a sheathing of iron wires seven times the cross-sectional area of the central conductor. Where the wires are not exposed to view, or where they are likely to be exposed to moisture, the outside conductor is also covered by an insulating material sufficiently to resist any effects of water. The sheathing, of course, forms the return conductor, and is of sufficient strength and rigidity to be capable of resisting all the strain that might tend to break or crush the wire.

The principle on which the claim of safety against fire-risk is based is the fact of the two conductors being so close together that there could not be an arc or any excessive heat in one without its influencing the other, and establishing a dead short-circuit. It would not, however, be sufficient to obtain this by simply bringing the two ordinary conductors side by side close together, because, in the first place, the conductors could not be brought so near to each other as to form a completely fused junction should an arc take place in one of them; and in the second, the fire would be exterior to the conductors, and would ignite anything in the neighbourhood. Nor would it be sufficient to make the surrounding conductor only the same weight as the central one, because in such a case the same defect would exist as with two wires side by side, viz., an insufficiency of metal. We believe the great difficulty in the system to be overcome hitherto has been the making of perfect electrical and mechanical continuity in the joints, especially in the surrounding conductor or sheathing, but we understand that under his recent patents Mr. Andrews has succeeded in a very simple way in getting over this difficulty.

SHIPBUILDING ON THE WEAR.—During the first six months of 1890, 45 vessels have been launched on the Wear, representing a total tonnage of 97,800, which, compared with the corresponding half of last year, shows a decrease of two vessels and 199 tons.

A NEW CHANNEL STEAMER.

BY invitation of Mr. J. H. Tritton (chairman) and the directors of the General Steam Navigation Co. a numerous company travelled on Saturday morning, June 14th, by special train to Parkeston Quay, Harwich, where they embarked on board the *Hirondelle* (the latest addition to the fleet of this company), which made a very successful trial run from Harwich to Gravesend.

The *Hirondelle* is the largest vessel yet built intended exclusively to run in the short Continental cargo and passenger trade. Her exact measurements are:—268 ft. long, 37 ft. 6 in. breadth, 18 ft depth of hold, 19 ft. depth, moulded. She is built in five watertight compartments, and a double bottom used as a ballast tank extending the whole length of the ship. Her main and 'tween decks are of iron, and her main deck is further covered in by an awning deck from aft to within 30 ft of the forecastle deck; there is therefore but 30 ft. of her main deck exposed. On the awning deck aft the music-rooms, smoking-room, chart-room, and a special state cabin are erected, and over this again there is a shelter deck for the further protection of passengers, and in amidships it is intended to be particularly available for the safe and commodious launching of the boats, which are on skids amidships, in the event of any casualty unfortunately demanding their use. In addition to two lifeboats and three other boats, separate floating apparatus and lifebuoys are appropriated for the use of every person on board the ship, including the crew, and in addition other parts of the ship's gear are made available as buoyant apparatus in the event of its being so required. The poop rail, where the poop deck and the forecastle deck do not meet, is carried up to the same height (7 ft. 8 in.), and is made up by means of the frames of the ship being carried up to the bulwark rail. The engines are amidships, and abaft the engines on the main deck, under the awning deck, is the principal saloon, and the state rooms for the first-class passengers Forward of the engines, and practically in the best part of the ship, is the second-class accommodation, whilst forward of that again, under the forecastle deck, is the third-class accommodation. The company gave much consideration to the question of where the first-class accommodation could best be placed, but it was found that in vessels of this size, where the nature of the business necessarily limits the length of the ships, the only means of providing spacious and airy accommodation for the first-class passengers was by berthing them aft. The hull and engines have both been built by Messrs. Gourlay Brothers, of Dundee. The sizes of the cylinders are—high-pressure cylinder, 28 in. diameter; intermediate cylinder, 44 in. diameter; low-pressure cylinder, 71 in. diameter; length of stroke, 48 in. She is lighted throughout by electricity, the dynamo and installation being provided by Messrs. W. C. Holmes & Co, Newcastle-on-Tyne. The vessel has been fitted to carry on long voyages 70 first-class passengers, 50 second-class passengers, and 25 third-class passengers, and has a cargo capacity for general purposes of about 2,500 tons, and her speed is to average as nearly as possible 14 knots on a mean draught of water not exceeding 17 ft. 6 in. On her trial trip on Saturday, June 14th, she ran the measured mile on a dead tide at a speed of 15½ miles per hour.

The company included Sir Arthur Blackwood (secretary, General Post Office), Sir Henry Tyler, M.P., and Mr. C. S. Reed (directors of the Great Eastern Railway Co.), Mr. Baughan, C.B. (Admiralty), Mr. C. E. Baines, C.B., Mr. B. Waymouth (Lloyd's Register), Fleet Engineer Traill (Board of Trade), M. Louis Coubert (Consul-General of France), Mr. R. Martell (Lloyd's Register), Hon. Colonel Bridgmann, Mr. J. G. Anderson, Colonel Plowden, Mr. Owen FitzGeorge, and others.

AN ADDITION TO THE WILSON LINE.

ON Wednesday, June 11th, the steamer *Montebello*, which has been built by Messrs. Richardson, Duck & Co, of Stockton, and engined by Messrs. Amos & Smith, of Hull, arrived in Hull for the second time, from Stockton, and she will in a short time be placed on the station between Hull and Christiania, in the mail and passenger service. The first time the *Montebello* arrived in Hull was some two months ago. On that occasion she was devoid of engines and boilers, and had to be towed round to Hull. Her machinery was all ready for her, and Messrs. Amos & Smith placed engines and boilers on board as she lay in the Albert Dock. Under her own steam she then proceeded to Stockton to have her saloon fitted and her outfit completed. This was to some extent accomplished on Wednesday sufficient to enable the *Montebello* to leave for Hull The *Montebello* is 290 feet long, with a breadth of beam of 35 ft., and she is over 1,700 tons gross. As she lay in the narrow river at Stockton it was not possible to get a good full-length view of the ship. Externally she is one of the smartest vessels of the Wilson Line. She is a ship of fine lines, and being spar-decked she presents an unbroken run fors and aft, with a good sheer. Steam was got up on Tuesday night, and at high water the engines were run for some time, everything being perfectly in order, and promising a successful trip on the morrow. The vessel left Messers. Richardson & Duck's ways shortly before ten on Wednesday forenoon, and there were on board as representing the builders, Mr. Surtees; for the owners, Messrs Spear, Bishop and Wilkins; and for the makers of the engines, Mr. Amos, Mr. Brackenbury, Mr. Hawkes, and Mr. W. Wagg, the latter of whom had special charge of the engines during the run along the coast. Mr. Harris, Board of Trade surveyor, Hull, was also on board. The Tees beyond Middlesborough is a narrow stream, and so large a vessel as the *Montebello*, which, it may be stated, is named after the Duchess of that name, has to be moved slowly. She was accompanied by a couple of tugs as far as Middlesborough, and by one down to the sea. When the Hull contingent left for Stockton on the previous afternoon they anticipated brilliant weather for the trip, but long before they reached the smoky place they found it had been rendered still more dingy by a heavy fall of rain, which, it may be stated, continued all night, and until the steamer had reached as far south as Flamborough Head. The trip was, as all official trial trips should be, a business and not a pleasure trip, and no more satisfactory run has ever been made by a Hull steamer. The vessel has accommodation for 72 first and 20 second-class passengers, and for a considerable number of emigrants, and is admirably equipped in every respect. The first-class saloon, situated 'midships, below the hurricane decks, is 38 ft. long and 21 ft. broad. The sides are adorned with hand-painted mahogany panels, executed by a lady, and representing birds and flowers, and the saloon is most luxuriously furnished with sofas and chairs upholstered in Utrecht velvet. At one end is a piano, and at the other a handsome sideboard. The apartment is lighted from the sides, the windows having flowered damask curtains, and by a lofty skylight in the centre. At night the saloon will be lighted by the electric light and, whilst in harbour, by elegant oil lamps. Adjacent to the saloon is a handsome smoke saloon. Below are the sleeping berths of the first-class passengers, spacious, well ventilated and lighted, and furnished with every regard to comfort. The captain's apartments adjoin the saloon. The cabins and berths of the first and second officers and the engineers flank the engine-room, which is abaft the saloon. The second-class passengers' saloon and berths are in the after part of the vessel, and though of course less luxuriously furnished than the first-class accommodation, do not lack comfort. Between decks are the quarters for emigrants, light, airy, and fitted up with every regard to sanitation. Right forward the seamen are comfortably housed. The vessel is furnished with every modern appliance for the safe and expeditious navigation of the vessel. The vessel has been not only built but entirely furnished and upholstered by Messrs. Richardson, Duck & Co., and must certainly add to the reputation of the firm. The last of the tugs was cast off shortly after 11 o'clock, and slowly for some time the vessel was kept on her course to the southward. The rain was falling heavily at the time, and the land, although she was at no great distance, was almost obscured. The temperature was, however, high, and the rain had knocked down the sea, which owing to a strong S.E. wind had prevailed on the previous day. A little offing having been secured, the engines were put on at full speed, and from this time until the Humber was reached, they were neither stopped nor eased down, and they drove the ship, notwithstanding that a foot of the propeller blades were above the water-line, at an average speed of a little over fourteen knots per hour. The run from the Tees breakwater to Spurn Point was accomplished in 6 hours, 48 minutes, which is perhaps the best time on record. This quick run was effected, in spite of the fact that all along the coast the vessel had to stem the ebb tide, and in fact the vessels were still swung ebb when the anchor was dropped in the Hull Roads. Some rather fast Scotch steamers, also going south, were very easily passed by the *Montebello*, which may be looked upon as a good 14-knot boat, and with her superb accommodation, and her electric lighting throughout, the passengers who will travel by her must be highly delighted, as were all on board during the trip. Generally there is some anxiety, and not unfrequently some trouble with new engines, but on this official trial trip there was neither trouble nor anxiety, for all worked as smoothly as possible, and great credit is due to Messrs. Amos & Smith, not only for the working of the engines, but for the handy manner in which the ship was steered by means of their patent steam steering gear. The engines are of the triple compound type, the high pressure cylinder being 24 inches, the intermediate 38 inches, and the low pressure 62 inches in diameter respectively, by a 42 inch stroke. Steam is supplied by four two single ended steel boilers, each 15 ft. in diameter, and 10 ft. 6 inches long. These boilers are fitted with Fox's corrugated furnaces and Henderson's patent self-cleaning bars, which have proved so successful in many other vessels of the Wilson Line. The working pressure of the boilers is 160 lbs. to the square inch. The *Montebello* is under the command of Captain Pepper, late of the *Rollo*, who has had 17 years' experience in the Scandinavian mail service.

LAUNCH OF A JAPANESE WARSHIP.

MESSRS. JAMES & GEORGE THOMSON, Limited, launched from their shipbuilding yard at Clydebank, on the 3rd June, the *Chiyoda*, a twin-screw warship of 2,450 tons displacement, built to the order of the Imperial Japanese Government. The vessel is of steel throughout, and her dimensions are as follows:—Length, 310 ft.; breadth, 42 ft.; depth, 23 ft. 8 in.; mean draught, 14 ft. Designs for the vessel were in the first instance supplied to the builders by the Japanese Government, but several important departures from these have been made, partly on the suggestion of the builders, with the concurrence of the Japanese naval constructors. The *Chiyoda* is in some respects similar to the Colonial cruisers, *Tauranga* and *Ringarooma*, building at Clydebank for the British Government, but is 45 ft. longer, and will no doubt be considered an improvement on these with respect to the maintenance of a high rate of speed at sea, and the furnishing of more commodious quarters for officers and crew. It is anticipated that the speed of the new warship under forced draught will be at least 19 knots, which is also the rate expected in the cases of the Colonial cruisers. The propelling machinery consists of two sets of vertical inverted triple-expansion engines driving twin screws. The engines are in separate compartments, divided by a longitudinal bulkhead at the centre line of the ship, and the cylinders are supported on wrought steel columns, bolted to a cast steel bedplate. The cylinders are 26 in., 39 in., and 57 in. diameter, and the stroke 27 in. The propellers are of manganese bronze, the pitch being adjustable. Steam will be supplied by six locomotive boilers, placed in two separate compartments forward of the engine-rooms. According to the original design, the ship was to have been fully rigged as a barque with the view of economising coal when cruising, but the designers subsequently decided that this consideration was not worth the weight and expense involved, and they adopted a purely fighting rig instead. Each of the masts will carry a military top containing a Gatling gun, and her light yards will be fitted merely for signalling purposes. When steaming at a speed of 10 knots an hour, the consumption of coal will be only about 12 tons a day, and the radius of action about 8,500 knots. In order to provide for manœuvring power, which is of considerable importance in the case of a vessel of the *Chiyoda's* class, a large balanced rudder has been fitted on the principle adopted in the *Reina Regente* and other warships by the same builders.

In the matter of protection against shot and shell, the *Chiyoda* has a feature novel to her class. The water-line for about two-thirds of its length amidships will be protected by a belt of rolled steel plates bolted to the outside of the shell plating, the thickness of the steel side at this point being 4⅜ in. The machinery and magazines, and also the buoyancy of the unarmoured ends, are, in addition, protected by a steel deck, with a mean thickness of an inch, extending from stem to stern. The plating of this deck is in two thicknesses or layers—the lower being of Siemens-Martin steel, of the same quality as the rest of the vessel, and the upper of chrome steel, a material which is found to offer greater resistance to the impact of projectiles than ordinary mild steel. The main armament will consist of 10 4·7 inch Armstrong quick-firing guns. Four of these will be mounted on each side of the upper deck on sponsons, and will fire through ports in the hammock berthing or bulwark; one will be mounted on the forecastle, and another on the poop, all of them being on central pivot mountings. Special arrangements will be made for the rapid supply of ammunition from the magazines to the guns. The auxiliary armament will comprise 14 4·7 millimétre Hotchkiss quick-firing guns, three Gatlings mounted on the tops, and three torpedo tubes on the Schwartzkoff system, one on each broadside and one at the bow. The accommodation for the crew is on the mess deck, immediately below the upper deck, the whole length of the deck being available for this purpose. The officers' quarters are partly on the mess deck and partly under the poop, where there is also a large cabin for the commander of the vessel, and a ward-room for the officers. Throughout the vessel will be lighted by electricity, and she will also have powerful search lights. On the 3rd she was launched with the greater part of her machinery on board, and her speed trials will, it is expected, take place as soon as the armament and minor fittings have been completed. The vessel has been constructed under the superintendence of Mr. M. Asaoka, Chief Constructor, Japanese Navy, and the machinery under the superintendence of Mr. H. Kurobe, Chief Engineer, Japanese Navy.

At the launch there was a large company. Amongst those present were:—Viscount Kawase, Envoy Extraordinary and Minister Plenipotentiary of the Imperial Japanese Government, and Viscountess Kawase; Mr. and Mrs. George Thomson; Messrs. T. Nakada, Secretary Japanese Legation, London; K. Nabeshima, Attaché, and Mrs. Nabeshima; T. Yamasaki, engineer, Japanese Navy; T. Uyeyama, Dr. Saiki; Captain Brown, Hon. Consul for Japan, Glasgow; M. Asaoka; H. Kuroba; and C. D. Donald, Glasgow. The naming ceremony was gracefully performed by Viscountess Kawase, and the vessel glided into the water amidst loud cheers. Mr. George Thomson then presented Viscountess Kawase with a handsome silver card case, on which was an engraving of the *Chiyoda*, as a souvenir of her visit.

The builders afterwards entertained the company to luncheon in the Model Room. Mr. George B. Thomson presided, and in proposing "Success to the *Chiyoda*," said the vessel they had seen launched was very similar to our Colonial cruisers. There was a slight difference in the length of the ships, but it was a difference which, he believed, would do the *Chiyoda* no harm, and might give her a little more speed. So far as speed was concerned, they hoped to get in the case of the new ship 19 knots an hour; and with a reduced speed of 10 knots she would have a coal capacity for 8,500 knots. Respecting her machinery, he said it had been constructed to the very smallest margin of weight with the greatest amount of power and strength. The locomotive type of boiler had been adopted in order to get a greater steam generating power. With all these features he believed the *Chiyoda* would prove a very strong addition to the Japanese Navy. The Japanese, he thought, were to be congratulated on going in for vessels of this class. They evidently did not desire their Navy to be left behind those of other nations; their idea was, he thought, to keep to the front as much as possible. Viscount Kawase, with whose name the toast was coupled, in replying, said it gave him great pleasure to visit Scotland and the city of Glasgow, and to witness a launch from a yard which had sent forth so many famous vessels. The proceedings of that day were, he assured the company, of great importance to his country. He did not doubt the vessel would prove a success. Mr. Asaoka proposed "The Builders." Mr. G. B. Thomson, in replying, said the occasion was in a way rather an auspicious one, for the *Chiyoda* was the first cruiser built in Scotland for the Japanese Navy. He only hoped it might be the forerunner of many.

TRIAL TRIP "CITY OF VIENNA."

ON June 11th this vessel, which was built by Messrs. Workman, Clark & Co., Limited, Belfast, and engined by Messrs. John & James Thomson, Finnieston Engine Works, Glasgow, to the order of Messrs. George Smith & Sons, Glasgow, went out on her official trial on the Firth of Clyde.

The *City of Vienna* is a vessel of 5,000 tons register, 412 ft. long, 46 ft. 4 in. beam, and 29 ft. 3 in. depth of hold, and is a splendid addition to the fine fleet of "City" Line steamers trading between the Clyde and India; she has three decks, the upper and main being steel covered with teak.

She is fitted throughout with all the latest improvements, and of the highest class, every modern requisite for the comfort of passengers and the expeditious handling of cargo having been adopted.

The propelling machinery of the *City of Vienna* is of special interest, and particularly the main engines, as they are a complete departure from previous arrangements of marine engines of high power; Howden's system of forced draught, of which the owners had previously acquired a very satisfactory experience, has been adopted, also Weir's patent feed pumps and evaporating apparatus, and to the engines has been fitted Morton's patent "valve-gear," Tom's patent slide valve being fitted to the low-pressure cylinder.

The engines of the *City of Vienna* are the largest to which this system of valve-gear has been hitherto applied. They are of the triple-expansion type, on three cranks, having cylinders 32 in., 53 in., and 87½ in. diameter respectively, and 5 ft. stroke, working at a boiler pressure of 160 lbs. per square in., and a piston speed of 700 ft. per minute.

The difference in the longitudinal engine room space occupied by the new engines, as compared with that which would have been occupied by engines with the same diameter of cylinders and ordinary link motion, designed to occupy the shortest space, consistent with having the crank shafts interchangeable, as in the present case, is over four feet, which in a ship of the dimensions of the *City of Vienna*, represents a very large and valuable increased cargo space, while with the new engines there is also the additional advantage of increased longitudinal main bearing surface, although there are fewer bearings, consequent upon the reduced length of sole plate, every working part of the engines is open and free of access, the valves being on the cross centre line of each engine, thus leaving a clear space from back to front between the engines.

Special attention has been given by the engineers to the design and finish of the whole engine, ample bearing surface having been provided in the working parts, with the means of easy and efficient lubrication available for the engineers in charge.

The performance of the engines on the preliminary and official trials were in every respect highly satisfactory, a speed of 15 knots per hour being attained, the engines working smoothly and no heating; at the conclusion of the trial the Messrs. Thomson were cordially congratulated on the success that had attended this new departure from their usual design and practice.

THE NORWEGIAN MAIL SERVICE.

ON Saturday, June 14th, by invitation of Messrs. Borries, Craig & Co., agents in Newcastle for the Holvorsen shipowning firm in Bergen, a party of gentlemen proceeded from Newcastle to inspect the new Bergen-built steamer *Britannia*, which has just been put upon the passenger and mail service between the Tyne and Norway. She is one of four steamers engaged in the traffic, the other three being the *Norge*, the earliest of them all; the *Mercur*, built in Norway; and the *Ragnwald Jarl*, recently constructed at Low Walker. The *Britannia* is a handsomely-modelled steamer, 275 ft. long and 35 ft. broad. Her triple-expansion engines, of 2,800 I.H.P., are by Messrs. Napier & Co., of the Clyde, and are capable of developing a speed of from 15 to 16 knots an hour. The voyage from point to point is accomplished in a little over 24 hours. The vessel is constructed entirely of English steel. Her internal arrangements are very complete and luxurious. The state rooms are comfortable and well furnished, even to the provision of a life-belt for each berth. The visitors were received on board the *Britannia* by Captain Benzen, and after having inspected the ship, were entertained to luncheon in the grand dining saloon. Mr. Jorgensen, the representative of Messrs. Borries, Craig & Co., presided.

The Chairman said that, on behalf of the owners of the steamer, the duty fell upon him of welcoming them there. Perhaps they would allow him to give them a short history of how that boat came to be built. Some seven or eight years ago, the owner, Mr. Holvorsen, sent them the *Norge*, to trade between the Tyne and Norway. She commenced in a very small way, with accommodation for about 15 or 20 passengers. Soon she required more room, and she was altered again and again, until she was able to take 80 or 100 first-class passengers. The passenger traffic increased very rapidly, and if they had had room, they would have been able to take 200 or 300 in the height of the season across to Norway. She was the pioneer of the trade, and, before she commenced, there was only one way of getting to Norway, and that was by Hull, where the boats ran once a fortnight, and, in the very height of the season, once a week. They got as many people as they could carry. At that time very few people talked about going to Norway; to talk about Norway was almost like talking of going to the North Pole—there was nothing to be seen but bears and ice. They had to make known that there was something else to be seen than everlasting ice and snow, and, with the assistance of the press, they were able to state that there was a good deal to be seen. There was another thing that struck people in Norway, and that was the difficulty of getting their mails carried quickly to England. The owner of the boat, Mr. Holvorsen, conceived the idea that if he could get the Norwegian Government to assist him in increasing the service, so as to quicken the mail service between the two countries, it would be a great advantage to the country. He made a proposition to Parliament and through friends in Parliament a Bill was brought in two years ago, but it was shelved till the following year, and last year a Bill was passed by the Norwegian Government empowering the expenditure of a certain sum to subsidise a line of steamers for the tri-weekly service between England and Norway for the carrying of the mails. It was expected, also, that this would give an impetus to trade, both in the exportation of Norwegian produce and in the importation of English manufactures. A contract was signed by the owner of that boat, together with two other companies, to carry the mails between England and Norway. A question arose as to which port in England the mails should be carried to, and there was very great difficulty indeed in getting some of the members of the Norwegian Parliament to agree to Newcastle being the place. Some people were for Leith, others for Hull. But they were able to lay before the Norwegian Government the facilities of the Tyne in the possibility of ships getting into it at any time of the tide, which could not, he believed, be done at any other port on the east coast of England; and they showed that there were also docks on the Tyne which they could enter at low tide, so that they could get their produce landed quickly, and their mails sent quickly to Newcastle. The River Tyne Commissioners had given them many facilities, and the North-Eastern Railway Co. ran special trains right down to the dock for the convenience of passengers. The *Britannia* was a boat close upon 2,000 tons gross, and had a speed of 15 or 16 knots an hour. She could accommodate about 180 first-class passengers. The four boats on the service were all first-class vessels, and the captains and officers and the crew would do all they could to make the passengers as comfortable as possible.

THE SOCIETY OF ENGINEERS.

ON June 17th a visit was paid to the works of the Thames Ironworks and Shipbuilding Co., at Blackwall, by the Society of Engineers. Over a hundred members of the society and their friends were present, the party including, amongst others the following:—Mr. Henry Adams (president), Mr. J. Wilson, jun. (vice-president), Mr. Joseph Bernays (past president), Mr. J. H. Cunningham (member of council), and Mr. G. A. Pryce Cuxson (secretary). The visitors, on arrival at the works, were received by Mr. A. F. Hills, managing director, and Mr. W. Hayward, the manager of the works, and were conducted over them in two parties by those gentlemen, who most courteously explained the chief features of the works. The works, which cover nearly 30 acres of ground, are situate in the parish of West Ham, and include the largest shipbuilding yard on the Thames, the number of men employed being over 3,000. For thirty years the company has been principally engaged upon the building of warships, and among the contracts in hand at the present moment special mention should be made of the fast cruisers in course of construction for the British Admiralty. The *Blenheim* (sister-ship to the *Blake*, now building at Chatham Dockyard) is one of the new fast cruisers for the British Navy. Her displacement is 9,000 tons, and her principal dimensions are:—Length, 375 ft.; breadth, 65 ft.; depth, 38 ft. She was commenced in September, 1888, and will probably be launched in the early part of next month She will be fitted with triple-expansion engines of 20,000 I.H.P., with twin screws, by Messrs. Humphreys, Tennant & Co. She is to attain a speed on trial of 22 knots per hour, and will be one of the fastest and most powerful cruisers of the Navy. It is expected that the *Blenheim* will be ready for service in about a year's time, and she will, when fully equipped, carry an armament comprising two 22-ton and ten 6-inch breech-loading guns, sixteen 3-pounder quick-firing guns, one 1-inch and seven 0·45-inch Nordenfeldt guns, and four 14-inch Whitehead torpedo tubes. On an adjacent slip (from which the *Warrior*, the first ironclad ever built for the British Admiralty, was successfully launched twenty-five ago) the *Grafton*, a cruiser of 7,500 tons, has been in progress for some seven or eight months, and in her present condition afforded the visitors an excellent opportunity of observing the construction of her double bottom and her protected deck. Her length is 360 ft., and her breadth 60 ft. She will be fitted with engines of 12,000 I.H.P., also by Messrs. Humphreys, Tennant & Co., which will propel her at a speed, under forced draught, of 19¾ knots. The *Theseus*, sister-ship to the *Grafton*, will be laid down on the slip now occupied by the *Blenheim*, as soon as the latter is launched. Her engines will be supplied by Messrs. Mandslay, Sons & Field. In addition to the work in hand for the Admiralty, the company is building several passenger boats for service in England and abroad. A considerable portion of the extensive workshops of the company is engaged in the construction of bridge, roofing, and girder work, buoys, tanks, &c., for which the company has numerous orders in hand. The two large dry docks facing the river Thames, together with the accommodation afforded by its extensive forge, rolling mills, iron and brass foundries, engine and boiler shops, place the company in a favourable position to undertake not only shipbuilding contracts, but to carry out the heaviest description of shipbuilding and engineering repairs. Every facility was given to the visitors to closely inspect the operations carried on at the works, the *Blenheim* being the central point of interest. Before leaving, the thanks of the Society of Engineers were conveyed to the company. Mr. Hills, in responding, pointed out the fact that the Thames, for some years a neglected shipbuilding river, was once more able to show that it still held the proud position of turning out only the best class of work, a sentiment which close observation enabled the visitors to heartily endorse.

INSTITUTION OF ENGINEERS AND NAVAL ARCHITECTS.

On Monday, June 16th, the Hull and District Institution of Engineers and Naval Architects held their annual general meeting of the fifth session for the election of officers for the session of 1890 and 1891, the President (Mr. Geo. Bohn, C.E.) in the chair. The first business was the election of the following gentlemen as members, viz.:—Messrs. W. F. Bayley, P. H. Richards, R. B. Fuller, and T. H. Dale. The election of officers was next proceeded with. On the ballot being taken Mr. C. F. Amos was elected president, Mr. H. W. R. Smith was re-elected vice-president, and Mr. J. Spear was elected to the vacancy in vice-presidents. Mr. Carson and Mr. Stirling were re-elected members of the Council, and Mr. J. R. Smith, Mr. F. H. Pearson and Mr. W. Harris were elected to the vacant seats on the Council. Mr. G. H. Strong was elected honorary secretary, and Mr. A. N. Somerscales honorary treasurer to the society.

Mr. Amos thanked the members for electing him president, and said he would do all he possibly could to further the interests of the institution, and hoped the coming session would be a successful one.

Mr. Spear, Mr. Strong, Mr. A. N. Somerscales, Mr. Harris, and Mr. J. R. Smith having returned thanks, Mr. Cole moved, and Mr. J. R. Smith seconded a vote of thanks to the retiring president for his services during the past two years. He (Mr. Cole) said he was sure Mr. Bohn had done his utmost to push the society on, and a more able or energetic president the society could not have had.

Mr. Bohn, in replying, thanked the members for their kind vote of thanks, and said he had tried to do his best for the society, and for so young a society it would be difficult to find one that had made more progress, but a great deal could be put down to their hon. secretary (Mr. Pearson) for the way he had worked and helped it on. He (Mr. Bohn) said he should still, so far as he was able, take the same interest in the society as he had done previously.

Mr. J. H. Leetham moved a vote of thanks to Mr. Pearson for the services he had rendered to the society as its hon. secretary for the five years it had been in existence. He was sure the society would never have a better secretary, and he was sorry Mr. Pearson had been compelled to resign through press of business. In moving the vote of thanks he coupled with Mr. Pearson the assistant secretary, Mr. D. K. Burnham.

Mr. Spear seconded the vote of thanks, and endorsed the previous speaker's remarks.

Mr. Pearson [illegible] replying, said he was very much obliged for the kind vote of thanks accorded him. He was sorry he had been obliged to resign, but business engagements prevented him from giving the attention to the society he would like to do. He thanked the members for electing him on the Council, and thus giving a practical proof of their appreciation of his past services.

The institution was formed in March, 1885, Mr. A. E. Seaton, C.E., and Mr. F. H. Pearson being the principal movers in the matter. Mr. Martin Samuelson, C.E., was elected the first president, and Mr. Pearson hon. secretary, and Mr. D. K. Burnham assistant secretary. Mr. Pearson remained hon. secretary until June, 1890, when he resigned on account of business engagements. On the retirement of Mr. Samuelson, Mr. Seaton was elected president, and Mr. George Bohn succeeded him. Mr. C. F. Amos is the president for the current session, and Mr. George H. Strong the hon. secretary, care of Charles D. Holmes & Co., Hull Engineering Works. Very good papers have been read at the meetings of the institution. The society have also offered each session several prizes for the best papers on engineering, naval, civil, and mechanical engineering subjects by graduates belonging to the society. The society have also exhibited models and engineering objects at the conversaziones which they have held, and there is every indication of the institution enlarging. The society exchanges its transactions, which are published annually, with other societies of a kindred nature. The society consists of members, associates, and graduates. Members consist of persons actively engaged in engineering and shipbuilding, civil, naval, or military engineers, or naval architects. Sea-going first-class engineers are admitted at a reduced subscription of 10s. per annum. Associate members are such persons not eligible as ordinary members, but who are connected with or interested in engineering and shipbuilding and kindred pursuits. Graduates are persons under 25 years of age, engaged in study or employment to qualify themselves for any of the above-named professions.

THE EDINBURGH INTERNATIONAL EXHIBITION.

II.

Located near the naval architecture exhibits in the west court are several important displays of indiarubber manufacture, chiefly among which is the stand of the North British Rubber Co., whose large works, designated the Castle Mills, are within ten minutes' walk of the exhibition entrance. At this important and most extensive stand many items are shown—several of them quite new—which must command the attention of all interested in marine engineering and the various adjuncts which render this branch of science so progressive in modern times. We hope to devote closer attention to the exhibits of this large company in a future issue.

Transporting ourselves at once to the Machinery and Electrical Hall, and, as may be understood from what was said in last article, losing very little that is of direct interest by the sudden transposition, the first thing to strike us is the magnificence of the housing provided for this, the central feature of the whole exhibition. The hall is much larger than the machinery section of the Edinburgh Exhibition of 1886, and while smaller in area than the hall devoted to machinery in Glasgow in 1888, it possesses many advantages which that building lacked. The Glasgow hall was 420 feet square, giving an area of 176,400 square ft., while the present one in Edinburgh is 700 ft. long by 150 ft. in width, giving an area of 105,000 square ft. But, as may be remembered by our readers who visited it, the Glasgow hall was unpleasantly crowded, owing to the passages for the general public being narrow; the roof being low, and, generally speaking, a feeling of confinedness being experienced. In Edinburgh we have a hall of great length and suitable breadth, with a central span 80 ft. in width, and a clear height of 43 ft. On each side of this is a 20 ft. wide span, and these again are flanked by a further space of 15 ft., which is under the continuous bays or gables which give character to the exterior of this portion of the exhibition buildings. The 20 ft. spans cover the main gangways for the public, who have thus a luxurious promenade.

Regarding the contents of this—from our point of view—the most valuable section of the exhibition we may say that apart from the purely electrical exhibits, which constitute the *raison d'être* of the whole display, we think that not a few items of fresh interest in connection with marine engineering fall to be noticed. This we hope to accomplish in future issues, but to render our present survey comprehensive, we herewith proceed to notice the contents generally of this important section of the exhibition.

Taking first the source of power for driving dynamo and other machinery, the boiler annexe naturally comes first in order. The annexe is a substantial brick erection, abutting against the machinery hall at the middle of its length and in full view of the section exclusively devoted to the machinery employed in the lighting of the buildings. Here are five of Galloway's well-known Lancashire boilers, 30 ft. by 8 ft., which form a battery most admirably adapted for the work alloted to it. The whole of these boilers, we understand, have been purchased by the North British Rubber Co. for their Castle Mills. In connection with these boilers are numerous accessories, which may well form the subjects of independent notice, such as Messrs. Carruthers & Co.'s duplex pumps for feeding boilers, Messrs. Gresham & Craven's injectors, Messrs. Schaffer & Budenberg's steam gauges, and numerous steam traps by Messrs. Lancaster & Tonge, of Pendleton. The steam from the boilers is brought into the machinery hall direct by one large pipe, while another is in reserve should the first fail. All main steam pipes and shafting, with pedestals, are supplied by Messrs. Kesson & Campbell, Parkhead, Glasgow.

The engines driving the dynamos and shafting form, by themselves, a most interesting exhibit. Messrs. Robey & Co., of London, lend all the engines employed in driving the dynamos. There are in all six engines by these famous makers. The first of these is a horizontal, coupled, compound engine of 80 H.P., with trip valve gear; high-pressure cylinder, 8½ in. in diameter, low-pressure 30 in., with a 40 in. stroke. It runs at 65 revolutions per minute. The fly-wheel is 15 ft. in diameter, and grooved for eight white cotton ropes, each 1¾ in. in diameter, which connect with the shafting for the machinery in motion. Next comes a 65 H.P. compound engine, with trip gear on the high-pressure cylinder. This cylinder is 15 in. in diameter, the low-pressure being 28 in., with a 28 in. stroke, and the whole running at 86 revolutions per minute. The fly-wheel is 12 ft. in diameter, and transmits motion by nine cotton ropes. Each of the above engines drive on to 4½ in. counter shafting, run at 230 revolutions. In each case the shafting carries six large steel pulleys, or twelve in all, of the preferential type made by Messrs. Tomlinson & Walker, York. The next engine is of 25 H.P., of the Robey fixed compound type. The cylinders are 9¼ in. and 16¼ in. diameter, with an 18 in. stroke. It runs at 143 revolutions per minute. The fly-wheel is 8 ft. in diameter by 11½ in. broad, and carries a leather belt instead of the cotton ropes in the previous case. This engine drives a large dynamo of Messrs. King, Brown & Co., Edinburgh, who have the contract for lighting the concert hall with large incandescent lamps of the Sunbeam type. Next is a high-speed compound engine, with cylinders of 5¼ in. and 9 in. diameter, and a 6 in. stroke. The fly-wheel here is only 3 ft. 6 in. in diameter by 8 in. broad. The engine runs at 300 revolutions per minute, and this high speed is utilised by driving direct, instead of through belting, a No. 7 brush dynamo for 15 arc lamps. The next part of this installation is two 8 H.P. vertical engines coupled with the fly-wheel, 7 ft. in diameter and 10 in. broad, between them. The cylinders are each 9½ in. diameter, with a 12 in. stroke. This engine drives a 35 arc light brush dynamo. The last of these Robey engines is a high speed one with cylinders of 10½ in. diameter, with a 10 in. stroke. The fly-wheel is 4 ft. 6 in. diameter by 9 in. broad. It runs at 285 revolutions per minute, driving a 15 arc light brush machine. Besides these seven fine engines belonging to Messrs. Robey, Messrs. Alley & McLellan, Sentinel Works, Polmadie, Glasgow, supply an ordinary type Westinghouse engine, with a 12 in. cylinder and an 11 in. stroke. The same firm also send one of their new triple-expansion high-speed Westinghouse engines. These drive direct four large dynamos, by Messrs. King, Brown & Co., for incandescent lighting.

In an exhibition originally intended to be primarily, if not exclusively, representative of electricity, and its various applications, it is, of course, only to be expected that there should be hundreds of other exhibits concerned with electricity besides those employed in generating and distributing the light throughout the buildings. The eastern half of the Machinery Hall is in fact almost entirely devoted to electrical exhibits. We need not here enumerate all the firms exhibiting in this department, but will confine ourself to briefly mentioning those who show electrical plant or fittings used in ship lighting. Of the firms exhibiting combined engines and dynamos coupled direct, such as are now all the fashion for ship lighting, we may first mention Messrs. Ernest Scott & Co., of the Close Works, Newcastle, whose principal items (stand 62) consist of three sets of engine and dynamo, the smallest of which represents the well-known "Tyne" dynamo and engine, already illustrated in the pages of this journal. The dynamo now shown is designed for 100 lights and is driven by a 6½ in. by 6 in. high-speed vertical engine. At stand 59 Messrs. Paterson & Cooper, of West Regent Street, Glasgow, have a good display of dynamos, combined engines and dynamos, switches, switch-boards, fuses and fittings of all kinds for ship-lighting, as well as buildings on land. They also show models of the s.s. *City of Vienna*, of the City Line, Glasgow; the s.s. *Parisian*, of the Allan Line, Liverpool; s.s. *Perth*, of the Dundee and London Shipping Co., all as fitted by the firm with electric light. At stand 60 the Woodside Electric Co. have a large display of dynamos for arc and incandescent lighting, including one plating dynamo driven by an electro motor, and a variety of lamps, switches, fuses, and other fittings for ship-lighting as well as land installation. Messrs. King, Brown & Co., of Rosebank Electric Works, Edinburgh, show at stand 63 two neat and new ship-lighting specimens of compound engines directly coupled to dynamos as one bed-plate. One of these combinations has capacity, with 120 lbs. steam pressure, for 700 16-candle power incandescent lamps, speed 300 revolutions per minute; and the other capacity, with 150 lbs. steam pressure, for 200 16-candle power incandescent lamps. In these machines the cylinder being below the armature shaft and bolted direct to the bed-plates makes an exceedingly compact arrangement. We hope to give fuller details and illustrations of these in a future issue. Amongst the large and varied collection of exhibits sent by Messrs. Immisch & Co., of Malden Electric Works, Kentish Town, London, are two electromotors designed for propulsion of launches. One is a launch motor of the type used by the Electric Traction Co. in the electric launches running on the canal adjoining the exhibition, and as used by the firm themselves on the Thames, and the other is a motor having rotating field for launch work. The whole of the plant, it may be here stated, for running the launches on the canal, is furnished by Immisch & Co The launches, four in number, were designed by Messrs. Morton & Williamson, consulting engineers, of Glasgow, and built by Messrs. T. B. Jeath & Co., of Rutherglen. The charging plant consists of a 25 I.H.P. engine, and an Immisch dynamo giving about 140 volts and 120 ampéres. Each launch is fitted with an Immisch 3·13 H.P. motor and special high speed propeller, and 48 "Electric Construction Corporation" accumulators designed for boating work. The reversing and governing gear is controlled by an Immisch patent switch fixed alongside the steering wheel. One man can easily control the launch. They are each seated for 40 passengers, are constructed of iron, and are capable of attaining a speed of about seven miles an hour, but owing to the canal regulations they are not permitted to run at a higher rate than five miles per hour.

Messrs. Rankin, Kennedy & Co., of North British Electric Works, Glasgow, at stand 71 makes a large display of dynamos, motors and meters, both for continuous and alternating currents, electro-magnetic machine tools, high speed steam-engines for electric lighting, &c. One of the motors shown on this stand is entirely new, and we hope to illustrate it in an early issue. There is no doubt a great future for this branch of electrical science, both in the way of machine-tool driving, actuating ship dock appliances, and the machinery of mills and factories of all kinds.

Employed driving dynamos in this section are several noteworthy engines of various sizes and designs. Messrs. Napier, Prentice & Co., of Stowmarket, Suffolk, show, in connection with their dynamos, a balanced high speed engine made by Messrs. Easton & Anderson, Erith Iron Works, Kent, the speed of which is 550 revolutions per minute, and is adapted to run as a compound engine with steam at 100 lbs. pressure, or to work each cylinder with 50 lbs. steam. Air engines are represented by the "Carnot" engine of Mr. George Clark, Richmond Square, Belfast; oil engines at the noteworthy stand of Messrs. Priestman Brothers, of Hull and Glasgow—one of which is employed for supplying current to the exhibition search light. At stand 57 Messrs. J. F. Blyth & Co, Limited, of 108, Fenchurch Street, London, and at Millwall, make an excellent display of their "Newall" high speed engines, a most compact and efficient type of engine, having only three working parts, and adapted for, amongst other things, the propulsion of steam yachts and launches.

The west end of the machinery hall is devoted to general engineering and miscellaneous exhibits requiring motive power. At the extreme end are numerous conventional and seemingly indispensable shows, such as working bakeries, confection stands, glass engraving, and brush-making stands, Jacquard looms, printing, folding, and bookbinding machinery, &c., but of these we need take no further notice. There is a very fair display of gas-engines, but with the exception of the "Fielding" engine at stand 188, there is, so far as we can see, no new type of this class of engine. The "Otto" is well to the front—shown by the manufacturers, Messrs. Crossley Brothers; while the "Griffin" and "Stockport" are also in evidence, shown by Messrs. Dick, Vnr & Co., of Kilmarnock, and by Messrs. J. E. H. Andrews, of Stockport, respectively. Two lines of shafting transmit the necessary power to the various machines in motion. One line is driven by an example of each of the above mentioned Otto and Griffin types of gas-engines, and the other by a splendid example of Messrs. Ruston, Proctor & Co.'s, makers of horizontal compound engines, several of which are shown at this firm's fine stand. The shafting, it may be added, is carried upon cast-iron A frames, 10 ft. high, supplied by Messrs. Kesson & Campbell, Glasgow.

In our last month's article we commented upon the comparative dearth of exhibits directly connected with marine engineering, considering the proximity of Edinburgh to Leith, Grangemouth, Dundee, and the premier district—the Clyde. In the present issue we give a detailed notice and illustration of Quiggin's patent evaporator, made by the Liverpool and London Condenser Co., of Brasenose Road, Liverpool, shown by their agents in the Leith district, Messrs. Fargie & Moncur, and by inadvertence referred to in last article as if appearing in another page of same issue. Amongst other exhibits of note, some of which we shall return to in future issues, are a patent hydraulic capstan and a patent crank shaft and pin, shown by Messrs. Hawthorn & Co., of Leith; Smiles' patent steam steering gear and plate hole cutters, made and exhibited by Mr. George Thwaites, of Stockton; and Stevens' rudder controller, shown by the Stevens Rudder Controller Co., of Walbrook, London. The new steam steering gear and telemotor, shown by Messrs. Brown, Bros. & Co., of Rosebank Iron Works; the patent vertical launch engine, shown by Mr. David Carlaw; and Cederval's patent protective lubricating box for propeller shafts, have all been already noticed in our columns.

Among the metals and alloys shown in the machinery hall, iron and steel is represented by the interesting exhibits of the Tredegar Iron and Coal Co., Tredegar, Monmouthshire, and of Messrs. Giers, Mills & Co., Ayresome Iron Works, Middlesbrough, who supplement their metallic exhibits by models of their works. Copper is represented by Elmore's Patent Copper Depositing Co., who electrolytically deposit copper, brushing it as the process proceeds, so that the deposit is remarkably homogeneous and compact and can be worked out in an immense variety of forms. Lead and lead products are represented by the exhibits of Messrs. Walker, Parker & Co., Elswick Lead Works, Newcastle. Aluminium, and the various alloys of which this wonderful metal prepared from clay forms a part, is well represented by the tastefully arranged exhibits of the Alliance Aluminium Co., of London and Wallsend-on-Tyne, and by those of Messrs. Leisler, Bock & Co., of St. Vincent Place, Glasgow. Delta metal is represented by the fine show of articles used for marine and other works made by the Delta Metal Co., London. Anti-friction metals for bearings are represented by the exhibits of the Magnolia Anti-friction Metal Co., London, and the Anti-altrition Metal Co., of Southwark.

Mr. John Bell, of Wishaw, shows a variety of his patent equillibrium-balanced governors; and Messrs. Schaffie & Badenberg, Glasgow, and Fargie and Moncur, of Leith, display multifarious marine engine fittings and appliances. Piston packing rings and springs are shown by Messrs. Buckley & Co., of Sheffield; Mr. John Macdonald, of Glasgow; Mr. Thomas Bowen, of Swansea; and Messrs. Alex. Mather & Son, of Edinburgh.

The heavy belting employed driving the dynamos and shafting in the dynamo court is largely multiple 1½ in. steel rope and the "Lancashire" type of canvas belting. A varied display of belting is, however, shown by Messrs. John Tullis & Son, Glasgow (leather), the Rosendale Belting Co., Manchester (woven hair, cotton, &c.), the Gandy Belt Co., Liverpool (American cotton belting), and Kebblethwaite Bros., Huddersfield (leviathan belting, driving ropes, woven belting, &c.). Lubricating oils are shown by Messrs. Graham-Yooll & Co., of Leith; and the solidified lubricating oil used in the Exhibition is supplied by Messrs. Fleming, Caroline Park, Edinburgh.

The only other section of the Machinery Hall which may claim any notice in a general survey in this journal is that of the locomotive annexe. In its own way it is certainly deserving of exhaustive notice, as it sets forth with a completeness which has not hitherto been attained—at least north of the Tweed—the evolution of railway travelling since its earliest practical inception. It would be out of place here to trace the chronological sequence of the several examples of locomotive design and practice shown, but they may be said generally to include examples of British locomotive practice very completely illustrating all the more important steps that have followed each other in the progressive development of the adaptation of the steam-engine to locomotive requirements during well-nigh the entire range of its history. The remarkable epoch of inventive and mechanical adaptation thus indicated may be said to extend from the year 1813 to the present day. From this period—that is to say—when Blacket and Hedley, taking advantage of Trevethick's discovery that traction was a possibility on a plane surface without—as had hitherto been essential—the intermediary of toothed racks or other gearing, constructed an engine which, by a suitable distribution of its mass, proved itself capable of hauling a train of eight small waggons laden with coal upon a smooth rail—to the present time, when it is no uncommon thing for a speed of 50 miles an hour, and more, to be continuously maintained upon our modern railways with a load of something like 300 tons! This series of exhibits certainly forms a collection well worthy of the visitor's attention, not only because there is hardly an object in it which is not worthy of note on account of its bearing upon the evolution of railway travelling, but because embodied in it are most beautiful examples of the very latest advances in locomotive engineering.

Our next article will deal specially and more exhaustively with Naval Architecture and Marine Engineering.

(To be continued.)

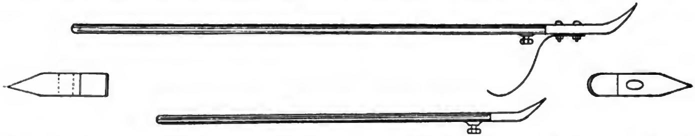
OBITUARY.

MR. DAVID ROLLO, of the firm of Messrs. David Rollo & Sons, engineers and boilermakers, of Liverpool, died May 28th, in his 69th year. The deceased gentleman was well known in commercial and shipping circles. A native of Glasgow, he came to Liverpool many years ago, and his intelligence, industry, and mechanical skill soon brought him into notice. He became partner with the late Alderman James Jack, and was for years associated with him in the conduct of the great engineering firm of Messrs. Jack, Rollo & Co., at the North-end of Liverpool. Mr. Rollo took an important part in some of the wonderful changes that have taken place in naval architecture and in steam navigation. When he first commenced business in Liverpool iron was not much used in the building of ships. The screw propeller was almost spoken of theoretically, but little used, the mode of propulsion for steam vessels being the paddle-wheel. Marine engines and boilers were of a very different type to those now in use in the great ocean-going steamships. Mr. Rollo and his partner, the late Mr. Jack, initiated many improvements in the construction of boilers, engines, screw propellers, and other apparatus connected with shipping. At their works at the North-end were turned out some fine specimens of engines and propellers of enormous magnitude, and not a few of the fine steamers sailing from the Mersey were engined by them. Subsequently Mr. Rollo severed his connection with the firm, and became the head of the engineering establishment of Messrs. David Rollo & Sons. In the latter capacity Mr. Rollo designed and carried out much important work in connection with steamships. He was much esteemed for his skill and experience, and his death will be regretted by many who were associated with him during his long and useful career.

LAUNCH OF TWO RUSSIAN VESSELS.—A St. Petersburg correspondent telegraphs:—The launch of the two new vessels belonging to the Russian navy took place on Saturday with the usual ceremonies, in presence of all the Imperial Family, the Italian Crown Prince, the Diplomatic Corps, and several hundreds of specially invited ladies and gentlemen. One ship is an ironclad gunboat of 1,500 tons, measuring 237 feet, and of 2,000 H.P. She has been built in less than 14 months, and was launched under full steam. The second launch was the large new Imperial pleasure yacht, which is engined to steam 20 knots an hour.

BOILER CLEANING TOOLS.

CONSIDERABLE ingenuity has been expended in recent years in the direction of reducing the deposit on the insides of boilers, but perfection is never likely to be wholly attained. It is therefore necessary to provide tools for removing the scale from time to time. It has been the aim in the present instance to lighten as much as posible what we have become accustomed to, and design a set of tools that will render accessible every internal portion of a marine boiler. To do this the handles are made tubular instead of solid, as hitherto; they are therefore easier to manipulate, both when being used for the purpose for which they are intended as also when being withdrawn for resetting the cutters, and for handling generally. They need not in the tubular form be less stiff than when solid, as will be understood. As the illustrations show, the cutters are removable, six being supplied in a set, instead therefore of several heavy slicers, only one handle-bar with the necessary cutter is used.

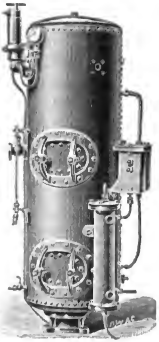


The spring-backed cutter is intended more especially for the lower parts of the combustion chamber, between the backs, ends or sides and shell of boiler. The spring being adjustable to whatever space there may be, keeps the cutter on to the part being scaled, and exerts a pressure which it is impossible to put on when working with a cutter in the usual way. Ordinary cutters may of course be used with these handles.

The scaling hammers are designed for cleaning the tops of corrugated furnaces. Having a curved cutting edge, it is claimed they do not nick the crowns as hammers with a straight cutting-edge do, and that the work is done much more quickly and effectually. Two handles are supplied with a complete outfit, one 4 ft. long, the other 2 ft. 6 in. It is needless to say the system enables the price to be reduced much below that charged for those commonly in vogue. For further information reference must be made to Mr. C. B. Casebourne, Victoria Terrace, West Hartlepool, who will be pleased to answer any questions.

EXHIBITS OF THE LIVERPOOL AND LONDON CONDENSER COMPANY AT EDINBURGH.

THE exhibits of the Liverpool and London Condenser Co. at the Edinburgh International Exhibition principally include specimens of fresh water condensers and evaporators manufactured on Quiggins' patent, and already extensively adopted in the Mercantile Marine. The exhibits include a 5-ton single evaporator, a 5-ton double or compound evaporator, and fresh water condensers from 500 to 6,000 gallons capacity per 24 hours. The evaporators produce pure distilled water from salt or other water, and are designed for use on board ship or on shore. They are made of various types—single, double, or triple—the general features of the make being preserved in each type. The illustration herewith of a 10-ton single evaporator will show these general features. Each type has an automatic feed regulator for preserving a constant level of water in the evaporator, and also, in connection, a special feed-water heater. The heating surfaces are composed of patent coils of a special design, the feature being that they taper in sectional area from the steam inlet end down to half the area at the outlet end. The steam used for evaporating the water on its passage through the coils, as it gives up its latent heat, contracts in volume. The surface of the coil is compressed gradually, so as always to preserve said surface in contact with the steam. These coils are made from solid drawn copper-tinned tubes of constant diameter, so that as fitted they have the advantage of a tapering section, but with a constant surface throughout. This gives a very high efficiency for a given quantity of steam used. Each coil is interchangeable, so that spare ones may be carried. The method of attaching the coils to the inside circular pipes is very simple and



effective, the joint being entirely a metallic one, needing no grinding nor grummet. The evaporators may be examined inside, and the coils taken out, through the manhole doors, in a few minutes, one man only being required for the purpose. In cases where a spare set of coils is carried dirty tubes may be taken out when necessary and the clean ones substituted in a very short time, the dirty ones being cleaned at leisure. From the construction of the evaporator internally, and its dimensions, the general trouble of priming, which is so constant in evaporators, is entirely overcome; and these machines are now largely used on steamers for the production of pure water, not only to make up the loss for the boilers, but also for making fresh water for passengers' use and for cattle. These evaporators are manufactured of a productive capacity up to 25 and 30 tons per 24 hours, and have been supplied for several cattle steamers. Many of the well-known steamship companies, such as the White Star Line, New Zealand Shipping Co., Australasian Co., General Steam Navigation Co., Red Star Line, &c., have already adopted this type of evaporator. The fittings and general workmanship are all first-class, the design of every detail of the construction giving evidence of long study as to the most suitable form.

The fresh water condensers or coolers are adapted to any existing pressure of steam, on account of the great strength of the internal parts. The cooling surfaces are formed of coils similar in design to those used in the evaporators, but smaller in diameter. These condensers have been tested and approved by the Board of Trade, who during the trials destroyed by hydraulic pressure three of the coils, the results showing that the coils only burst at a mean pressure of as much as 1,700 lbs. per square inch. The coils are made of solid drawn copper and are thoroughly tinned inside and outside, the ends connecting them to the diaphragms being screwed on and brazed, and no soft solder is used in any part. The connection of the coils to the diaphragms is of a special design somewhat similar in construction to the connections used in the evaporators, neither grinding nor grummets being employed. These fresh water condensers, on account of their excessive strength, do not require safety-valves on either of the water or steam spaces, and they may be worked directly from high-pressure boilers. The condensers are shown made of copper as well as cast-iron, copper condensers being largely used in men-of-war, yachts, &c., where lightness is an especial feature.

SEARCH LIGHT PROJECTOR.

THE engraving, Fig. 1, shows one of a number of Search Light Projectors specially constructed by Messrs. Charlesworth, Hall & Co., Oldham, for use on small vessels in the night navigation of rivers, canals, and narrow channels. The projector barrel is 16 in. diameter, rolled out of steel sheet and tinplated, making a very strong job. The mirror is Chance Bros. best quality 16 in. diameter, 8 in. focus, fitted in a strong brass frame with a bayonet socket attachment to the barrel to facilitate removal for cleaning, &c. A dispersing lens, also by Chance Bros., having an angle of dispersion of 16 deg., is attached by means of a hinged frame to the forward end of the barrel in order to fantail the light so as to spread it on the banks. The arrangements for ventilation are very complete, both the mirror frame and projector barrel being so arranged that a constant stream of cold air passes through, so preventing overheating of the mirror and destruction of the silvering. An instrument similar to a camera is provided at one side of the projector for viewing the arc. The hand lamp is made attachable and quite independent of the projector itself. The feed of the carbons is obtained by a right and left hand thread screw in the usual way. A screw is provided for raising and lowering the carbons, and adjustments are arranged for setting the point of the carbons from below without having to put the hand in the barrel, as is necessary with other projectors. With carbons 20 millimetres diameter and a current of 45 amps, these projectors will illuminate a distance of 1,200 yards. Fig. 2 shows one of a number of very light and compact sets of electric light machinery, also made by Messrs. Charlesworth, Hall & Co., specially suitable for ship lighting (supplied with the above projectors). One of these sets is here shown, comprising an engine with cylinders 4 in. and 5½ in. by 4¾ in. stroke, driving a Hall dynamo direct at 500 revolutions per minute, with an output of 65 volts, 50 amperes, the steam pressure being 60 lbs. per square inch. As will be seen the engines are of the open frame type, the cylinders being supported on four steel columns, which also carry the crosshead slide. Both cylinders are fitted with piston valves,

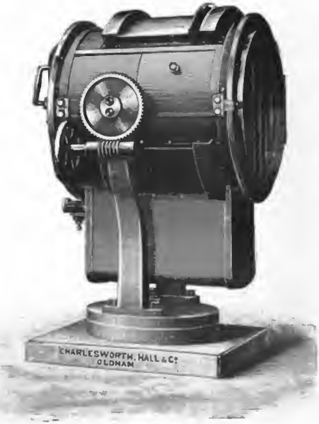


FIG. 1.

recently (21st June) intimated to men in some of the departments that reductions would take place a month hence. What these reductions actually may be it is difficult to say; but that they will be pretty extensive may be taken as certain. The Fairfield concern, as is well known, is outside the Employers' Association, and the fact that it has been the first to give notice of pending deductions, shows that the Clyde employers generally are fairly unanimous in believing that the state of trade does not warrant a continuation of the big wages. The proposed reductions will not take place till after the Glasgow Fair holidays—about the latter end of July.

A large number of workmen have recently been paid off from two of the Greenock shipyards: all the vessels on the stocks being nearly completed. Similar discharges are likely to take place in other yards nearer Glasgow. At Grangemouth the riveters in the Dockyard Co.'s works have struck work in consequence of the employers declining to continue the advance of 6d. weekly, which was recently granted.

It has again been publicly stated, but the assertion seems to lack confirmation, that the Hamburg-American Steamship Co. are so well pleased with the maiden efforts of the *Normannia*, that they have commissioned the Fairfield Co. to build a duplicate steamer of 8,500 tons. Whether this be so or not, it is certain that several of the large Clyde shipbuilding firms have been asked to look into the design of, and quote for, a large powerful mail steamer of about 6,000 tons.

The few contracts actually placed since last month's Notes were written, include a stern-wheel steamer 160 ft. long, 24 ft. broad, and 7 ft. deep, which Messrs. M'Arthur & Co., of Abbotsinch, Paisley, are to build for Messrs. Cook, tourist agents, for their passenger and other traffic on the Nile; a cargo steamer, which Messrs. Alex. Stephen & Sons, of Linthouse, Govan, are to build for Mr. J. B. Murray, Glasgow, and similar to the *Asphodel*, built by this firm for the same ownership a short time ago. The price for this latter vessel is said to be little over £8 a ton, which is a great reduction on the sum paid for similar ships only a few months ago. A Greenock firm have also received the order to build two light-draft twin-screw steamers, for service on the River Amazon.

At Dundee work is not relatively any more plentiful than in the Clyde district. Messrs. Gourlay Bros. & Co. have received during the month an order from the General Steam Navigation Co. of London, an order to build them a new steamer. The Messrs. Gourlay, it may be stated, have already built 20 vessels for the same owners.

The launches on the Clyde during the month of June have been numerous; the output representing about 25,000 tons. Of the individual contributions to this total the more important ones were:—The *Chiyoda*, a steel twin-screw warship, 2,450 tons, and 6,500 H.P., built by Messrs. J. & G. Thomson, Limited, Clydebank, for the Japanese government; the *Scindia*, a 4,300-ton steamer for the Anchor line, built by Messrs. D. & W. Henderson. of Partick; and the *Frederica*, a steel twin-screw steamer, 1,100 tons and 3,000 H.P., the first of three similar vessels building by Messrs. J. & G. Thomson for the Channel service of the London and South-Western Railway Co. A goodly proportion of the launches were of sailing vessels; the largest of these being the *Templemore*, having a carrying capacity of 2,800 tons, built by the well-known Port-Glasgow firm, Messrs. Russell & Co., for Messrs. Thomson, Dickie & Co., Glasgow. Another noteworthy circumstance in the month's doings was the launching, at one time, of as many as four vessels from the yard of Messrs. D. & W. Henderson, Partick. These were medium sized schooners for the coasting and up-river traffic of the Allan line service to South America.

The screw-steamer *City of Venice*—the latest and finest of the "City" line fleet, was tried for speed on the Clyde measured mile on the 11th June, and attained a speed of 15 knots per hour. She has been built, like most of the other vessels of the "City" fleet, by Messrs. Workman, Clark, & Co., of Belfast, while the engines are by Messrs. J. & J. Thomson, of Finnieston, Glasgow, who have already made nine sets of engines and boilers for the same owners. Other two vessels are in hand for the "City" line by Messrs. Workman, Clark, & Co.; Messrs. Thomson also making the engines.

Messrs. J. & G. Thomson, Limited, of Clydebank, have started an electrical department in their already extensive works, and will now—like Messrs. William Denny & Bros., Dumbarton—fit all the vessels built by them with electric light. The first to be fitted is the *Frederica*, already mentioned, a handsome and well-appointed vessel for the London & South-Western Railway Co.'s mail and passenger service between Southampton and the Channel Islands.

A new steel works is being projected under the title of the "Calderbank Steel & Coal Co., Limited." The works are to be erected on the site formerly occupied by the major portion of Monkland Iron Works, at Calderbank, including the "Ferrie" blast furnaces. This site extends to about 37 acres, and it is estimated that the works to be erected will be capable of turning out from 50,000 to 60,000 tons of steel per annum. There are also two valuable mineral properties. The directorate is closely connected with the well-known firm of Messrs. P. & W. Maclellan, and an equally well-known firm of iron merchants, both of Glasgow. Mr. J. W. Wailes, formerly of the Patent Shaft and Axle-tree Works, in South Staffordshire, is to be the general manager. He has been for several months on the ground and has matters fairly well in trim for beginning operations on the new works.

The new steel works at Dumbarton, under the spirited managership of Mr. William Jardine, jun.—formerly with Messrs. P. & W. Maclellan, are now assuming a finished-like appearance. Most of the plant—including a splendid new rolling mill of heavy calibre—is now in position, and it will not be very long before an actual start is made with the manufacture of steel plates and angles. The supply, for a time at least, will be altogether local.

Messrs. Haythorn & Stuart, of Eastwood Engineering Works, Pollokshaws, Glasgow, who supplied a goodly proportion of the parts for the rolling mill above referred to, are receiving encouraging support for Haythorn's patent piston rings from some of the best marine engineering firms on the Clyde. Several sets, some of them for cylinders of very large diameter, have recently been supplied to Messrs. Denny & Co., of Dumbarton. Haythorn's patent metallic packing is also in demand.

Messrs. Alley & MacLellan, of Sentinel Works, Polmadie, are busy in all departments of their extensive works. Their patent triple-expansion Westinghouse engines—an example of which attracts much attention in the machinery hall of the Edinburgh Exhibition—are rapidly making a name for themselves, and the firm are receiving numerous orders. There are on hand at the present time, or on order, about 200 sets, the I.H.P. varying from 30 to 150.

Mr. W. G. Wrench, consulting engineer, of 5, Oswald Street, Glasgow, whose patent oblique-bladed screw-propeller is already largely in demand, has just earned additional *prestige* for his valuable invention through the fact that the twin-screw *Flowerdale*, of Mr. Macbrayne's well-known West Highland fleet, after having been tried with propellers of ordinary make, has been fitted and tried with the Wrench propellers; the result being an accession to the speed of as much as 1¼ knots.

The s.s. *Duchess of Hamilton*, the new crack steamer of the Caledonian Steam Packet Co., doing service between Ardrossan and the Island of Arran, is one of five fast paddle boats which Messrs. Denny & Co., of Dumbarton, have produced within a year, all having engines of the same type—although slightly varying in size—on Brock's patent diagonal compound principle, as clearly exhibited by model in the Edinburgh Exhibition. The names of the vessels are the *Princess Henriette* and *Princess Josephine*, now on the Channel service between Ostend and Dover, the mean speed of which on trial was 21·28 knots; the *Princess Victoria*, now on the route between Stranraer and Larne, whose mean speed on trial was 19·77 knots; the *Clacton Belle*, now on the service between London and Clacton-on-Sea, whose mean speed on trial was 17·07 knots; and the *Duchess of Hamilton*, already mentioned, whose true mean speed on trial was 18·09 knots, and earned for her builders the handsome premium of £3,000. A few particulars of the machinery of this successful vessel will be of interest. The vessel herself is 246 ft. long by 26¼ ft. beam; 10 ft. depth, and her engines are compound, diagonal, two-cranked, with cylinders 28 and 50 in. diameter, and 5 ft. stroke, and the boilers, two in number, are of the Admiralty type, working under forced draught at 115 lbs. pressure. In the engines steel has been used wherever practicable with the view primarily of weight saving. Frames, bed-plates, main bearing caps and bushes, pump levers, paddle centres, pistons, and cylinder covers, are all of cast-steel. The shafts, guide-columns, paddle arms, brackets and rings, connecting and piston rods, valve and pump gear, &c., are all of forged ingot steel. The condenser shell is of plate steel. The sea chests, stop and safety valve chests, air pumps, condenser doors, &c., are of brass. The valves are placed diagonally on cylinder—

H.P. valve of piston type and L.P. valve common slide. Forced blast on the closed stokehole system is used, Brotherhood's fans being employed for this purpose. The circulating water supply is by Gwynne's and by Drysdale's centrifugal circulating pumps, fan cases of which are of brass. The feed water for boilers is supplied by Weir's pumps, which have been specially designed to save weight. The *Duchess of Hamilton* is also fitted with a Rayner's patent distiller.

The performances of this, and of the other new paddle steamers introduced to the passenger carrying fleet on the Clyde this season, and noticed in last month's Notes, are attracting great attention, and much is being written and said as to the comparative merits of the modern vessels and the crack river boats of 30 years ago. The advance in speed, certainly, does not seem to be remarkable, but an unfair comparison is made in regarding the direct and tide-aided fast runs of the old boats as parallel with the *mean results* of the series of trial runs, with and against the tide, which all modern steamers must now undergo. Again, the modern boats are both broader and more lavishly fitted craft than the shells of 30 years ago, and they present more surface to the wind, the resistance due to which is an element of considerable importance in paddle steamers.

The proposed Industrial Exhibition, to be held during the winter months of this year in the east end of Glasgow, seems likely to be brought to a successful issue. The guarantee fund has already reached upwards of £3,000, and further promises of monetary support continue to be received. An arrangement has been come to whereby the cordial co-operation and influence of the Glasgow United Trades' Council is secured for the promoting and carrying out of the exhibition. Mr. J. R. Chalmers, writer, has been elected to the office of secretary.

TRADE NOTES FROM THE TYNE, WEAR TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The outlook in the shipbuilding trade is every day becoming more gloomy, and the anxieties of shipbuilders and others connected with the industry are being increased to a proportionate extent. Very few, if any, contracts have been negotiated this year, and it is stated on good authority that some of the most important firms on the river have not booked an order since October last. Vacant berths are consequently becoming more numerous, and some of the yards are beginning to wear quite a desolate appearance. The laying up of working steamers is another bad omen for the future, which is just now presenting itself, and unless freights should take an unexpected upward bound, this feature will soon become disagreeably conspicuous not only on the Tyne, but at all the leading ports. The majority of the vessels that are likely to be laid up, will, of course, consist of those with compound engines and structural arrangements of an antiquated kind. In a time of low freights like the present it was bound to become manifest that boats of this class could not profitably be kept in competition with the greatly superior vessels that have been built since the advent of steel as a constructive material, and the introduction of the more effective and economical propelling power, which marine engineers have recently placed at the disposal of shipowners. The old iron vessels must, indeed, go the way of the old wooden ones, and it is not hazarding too much to say that a good proportion of the steamers that may be laid up in the various ports of the country during the next few months will never again be returned to the former lines of work. Some of course may be partly reconstructed and fitted with new engines, while others may pass into the hands of owners, who without going to much expense for alterations, may utilise them with advantage in coasting traffic; but not a few will be permanently laid aside and removed from the register, as being incapable of profitable working in any trade. These of course must in time be replaced, and the work of building substitutes, added to the repairing of such vessels as are considered worth the trouble, will, it may be hoped, bring about an earlier revival in the shipbuilding industry than might have been expected to take place in the ordinary course of things. An interval of slackness however is now to be faced, and during the coming winter it may reach a very serious stage, unless the cost of production is so materially reduced as to enable builders by lowered quotations for tonnage to induce owners to begin the substitution of properly equipped new vessels, for some of their useless old ones, sooner than they might otherwise do. The cost of material has already been considerably reduced, and shipbuilders have reduced their prices accordingly, but shipowners are looking forward to getting more favourable terms still, and as there is no pressure upon them by merchants, they can afford to wait till such are offered. A reduction of wages is but the natural concomitant of a decline in the prices of material, and that this will soon be demanded by the employers in both the shipbuilding and engineering trades of the Tyne, and probably of the whole North-East Coast, is now a matter of current talk.

At the Elswick yard of Messrs. Armstrong, Mitchell & Co. there are now but four vessels on the stocks, two of these being cruisers ordered by the Admiralty, and two, war vessels of a different type, and of somewhat small dimensions, that are being built for foreign governments. One of the Admiralty cruisers is in quite an advanced stage, and will be ready for launching in a few weeks from now. Besides the vessels on the stocks, there are six vessels of the cruiser type being fitted out in the river, and the work remaining to be done in connection with the latter is very considerable. At the Low Walker yard of the firm berths are being emptied rapidly, and as there is no frame turning going on, they are not likely to be filled up very soon. It is stated that two or three of the oil ships now building by the firm have been put down on "spec.," and the fact that one has been launched without a name is, in some degree, confirmatory of the statement. Messrs. Wigham, Richardson & Co. have two passenger vessels beside the yard fitting out, and others on the stock, in various stages of construction. A large passenger steamer, named the *Donau*, has arrived at the yard, presumably for repairs or alterations. The vessel is now moored beside the works. Messrs. Hawthorn, Leslie & Co. are busily preparing for launching a finely-modelled passenger vessel ordered by foreign owners. The firm are putting the finishing touches to several vessels that are moored beside the yard, and are carrying out rather extensive repairs on one that has been placed in the graving dock. At Messrs. C. S. Swan & Hunter's yard business continues active; and at Messrs. R. Stephenson & Co.'s yard, though there are only two vessels on the stocks, a full complement of hands is kept on. The Palmer's Shipbuilding & Iron Co. having by extensive piling, adequately strengthened the foundations, have laid the keels for the two ironclads ordered by the Admiralty, in two of their largest berths. The company are making rapid progress with the three cruisers that were laid down towards the close of last year in their Howdon yard. The Tyne Shipbuilding Co. maintain a good show of work at their establishment, having three large vessels on the stocks, and one in the river fitting out. Messrs. Readhead have a large foreign vessel at their yard for repairs, and their building berths continue fully occupied. The boat attaching and detaching gear of Captain E. Marshall & Co., Park Crescent, North Shields, is attracting considerable attention, and appears to be rapidly coming into favour among those most interested in the effective working of such appliances. Exceptional qualities of great value are claimed for this gear, which was awarded the medal and diploma at the Newcastle Exhibition, 1887, and has received the approval of the Board of Trade.

Engineering.—The most important incident in connection with engineering that has taken place during the month, is the placing of the contract for the machinery of the cruisers *Æolus* and *Brilliant*, now building in two of the Government dockyards, with Messrs. R. & W. Hawthorn, Leslie & Co., who within the past few years have been the recipients of many similar important engineering contracts from the Admiralty. In this connection it may be stated that the contract for the whole of the shafting and also for the boiler furnaces has been placed with Messrs. John Brown & Co., Limited, Sheffield. The marine engineering establishments generally keep busy, though, as few new orders are being received, a falling off of briskness must necessarily soon take place. Messrs. H. Watson & Sons, of the High Bridge Works, Newcastle, continue to be extremely busy in their brass founding and finishing departments, in which overtime is being extensively resorted to. The firm are now engaged in fitting their well known "Triumph" pumps on board the gunboats and cruisers now in course of construction for the home Government at Elswick, Hebburn, Jarrow, Hull, and London. In connection with the placing of these pumps, the firm are fitting special pumping arrangements in the whole of the vessels, and have in every case a contingent of their own workmen engaged in carrying out the work. Messrs. Ernest Scott & Co., of the Close Works, are fully supplied with orders for Admiralty pumps and other engineering specialities. They have also a large amount of electrical work in hand. The firm are now showing at the Edinburgh Exhibition some most interesting specimens of their electrical machinery, which will doubtless be noticed at length in a future issue of this journal. Messrs. John Abbot & Co., of Gateshead, continue very busy in their ironfounding and general engineering departments, and their anchor shops are also in full swing. Messrs. Black & Hawthorn are just now engining a vessel of large size at Newcastle Quay, and the different departments of the works continue briskly employed. The Elswick Ordnance Works keep busy, and both steel and iron works throughout the district, though not so pressed with orders as they have been, are still fairly well employed.

THE WEAR.

Shipbuilding.—Some of the leading shipbuilding firms on the Wear have now got to the end of their orders, and a great amount of building space will soon be vacant unless builders find it expedient to put down boats on "spec." There is not much encouragement for them to do this, however, as the workmen, when such a thing is done, usually misinterpret the motive which dictates the act, and invariably become more difficult to deal with, when there is an apparent increase of work not stopping to inquire whether it is speculative or otherwise. Among the firms who have their last orders on the stocks is Messrs. J. L. Thompson & Sons, who up to the present have usually been better supplied with work than their neighbours, and whose extensive resources in the way of working plant enable them to go into the market with exceptional advantages. The firm have now in progress a large tea ship, which will be launched inthe course of a few weeks, and this, we believe, will make the fifth vessel turned out by them for employment in this special trade. Messrs. Blumer & Co. launched on the 18th inst. a large steamer named the *Brenttor*, built to the order of a London firm. The firm have still two boats on the stocks, but it is understood that they have no orders in reserve. Messrs. R. Thompson & Sons are preparing to launch a vessel to be named the *Millendreno*, and are building a sister ship, which is said to be as yet unsold. The firm have recently launched a trawler named the *Lincoln* from their Bridge Dockyard, and they have now undergoing extensive repairs at the last-named establishment a large vessel named the *Antonio*, of London. The engines and boilers of the same vessel are, it may be stated, being repaired and in part reconstructed by Messrs. George Clark & Co., Southwick. Messrs. Short Brothers launched, on the 18th inst, the thirteenth vessel built by them for the Prince Line, and the keel for another vessel is now being placed in the vacated berth. On the same day Messrs. Pickersgill launched the largest vessel yet built by them, and which they could not have built prior to the recent extension of their yard, which gives them greatly increased building space. The vessel, which was built to the order of a local owner, was named the *Melbourne*. Messrs. W. Doxford & Sons have four berths occupied, one of the vessels on the stocks being the first of two ordered by the British India Steam Navigation Co. The other vessel is now in the initiatory stage of frame-turning. At Mr. Laing's yard, Deptford, briskness is still maintained, there being on the stocks four vessels of large size, besides several under repair in the graving docks and in the river. An attempt was made to launch the steamer *Baria*, of Hamburg, on June 4th, but owing to an accident the vessel was suddenly stopped in her course before getting clear of the "ways." She lay in a somewhat awkward position for several days, but was eventually floated without, as we understand, having suffered any damage. Messrs. John Priestman & Co. continue busy, all the building berths being occupied. It is reported that the firm contemplate an extension of their building space. At the time of writing the rivetters at this establishment are out on strike, with the avowed object of obtaining the dismissal of a foreman, who has in some way incurred their illwill. It remains to be seen how this matter will end, but it certainly seems an arbitrary proceeding on the part of the men to try to dictate to the employers as to whom they shall place in positions of trust.

Engineering.—The North-Eastern Engineering Works, South Docks, are still in full activity—night work continuing to be maintained in nearly all departments. The contracts in progress however were all booked last year, and when these are worked up it is feared that there will be nothing to replace them. At the Palmer's Hill Works no symptoms of slackness have yet appeared, but it is pretty well understood that the existing briskness cannot be much longer maintained. Messrs. Doxford are busy with two exceptionally powerful sets of engines for vessels being built in their own yard, and have also several smaller sets in hand, and at Messrs. Clark & Co.'s works there are still enough orders to keep the different departments briskly going. Messrs. John Lynn & Co. are still enabled to keep a full staff of operatives employed on steering gears, steam winches, &c., and the establishment of Mr. John Wigham, of Hylton, is also kept pretty busy with work of a similar kind. Forges are for the most part fairly busy, and in the iron foundries work continues tolerably plentiful. The agitation of the Monkwearmouth miners for a seven hours' shift, which was alluded to in last month's notes, has, as was anticipated, developed into a strike, and as both parties to the dispute are very determined to "hold out" in the maintenance of their respective contentions, the stoppage of work which has been brought about is likely to be a long one. The horses have been brought out of the pit, and are now stabled in temporarily erected sheds near the pit's mouth. This action alone shows how much in earnest the owners are, in opposing the introduction of exceptional arrangements as regards the working hours at their colliery. The latest phase of this dispute is that the Council of the Durham Miners' Association have sanctioned the strike which proceeding involves the payment of 10s. per week from the Union funds to each of the strike hands as long as they remain "out." This decision renders the prospect of a settlement still more remote, and unless the owners can get strange hands to take the places of those on strike, the resumption of full work at the colliery will now be indefinitely delayed.

The Hartlepools.—The three shipbuilding firms at this centre are still fairly well supplied with orders, Messrs. W. Gray & Co., Limited, being the best off in this respect. This firm have recently launched a splendid vessel of 6,300 tons carrying capacity, which has been built to the order of Messrs. the Shaw, Saville, and Albion Co., Limited, and is intended for the New Zealand trade. The shipping of the engines and boilers, which have been manufactured at the Central Marine Engine Works, has been carried out within the past couple of weeks, and will, no doubt, constitute the most important item in this month's operations at the works. The vessel is being fitted with propeller blades of manganese bronze, which metal, as cast at the Central Engine Works, is gradually progressing into favour with owners of large steamers, a circumstance which is not surprising when it is considered that by the use of the metal a higher rate of speed can be attained than can be got with either cast-iron or steel. The vessel, it should be stated, has been named the *Rangatira*, and one precisely similar is now on the stocks at Messrs. Gray & Co.'s yard, having been ordered by the New Zealand Shipping Co., and being intended for the same trade. The new forge at the Central Marine Works is now in full operation, and some of the hammers are working double shift. Every possible facility has been provided at this forge for expediting repair work, and that the almost unique resources are effectively utilised, may be gathered from the fact that quite recently a large new tail end shaft was made and fitted, with its liners, propeller key and nut complete, coupling holes bored, and the shaft delivered to the ship in two-and-a-half days, thus obviating the necessity of the vessel being detained in dry dock for want of it. The boiler department at the Central Engine Works is also now fitted in an exceptionally liberal manner with hydraulic and other tools, so that almost any size of boiler can be turned out in from six to seven weeks from date of order, and there is a prospect, by the use of tools that are on order but not yet delivered, of still further reducing the period of manufacture. At the docks business is now brisk, timber imports being very numerous.

Stockton.—There is still a fair show of work at the Stockton shipbuilding yards, but inquiries are few, and it is feared that vacant berths will soon be a conspicuous feature. Since May 20th the following steamers engined by Messrs. Blair & Co. have had successful trial trips:—The s.s. *Austria*, built by Messrs. Austin & Son, Sunderland, for Messrs. Baily & Leetham, of Hull, having engines of 160 N.H.P., with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. The s.s. *Nethergate*, built by Messrs. Turnbull, of Whitby, for Messrs. Turnbull, Scott & Co., of London, having engines of 175 H.P., with cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The s.s. *Inverness*, built by Messrs. Ropner & Son, of Stockton, for Messrs. Sanderson & Co., of Hull, having engines of 160 H.P., with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. The s.s. *Gulf of Ancud*, built by Messrs. Hawthorn, Leslie & Co., of Hebburn, for Messrs. the Greenock Steamship Co., having engines of 300 N.H.P., with cylinders 26 in., 42 in., and 69 in. by 48 in. stroke. The s.s. *Gulf of Venice*, also belonging to the Greenock Steamship Co., which has been at Stockton for some time having her old compound engines, 43 in. and 80 in. by 54 in., converted into the triple-expansion type of three cylinders 26¼ in., 43 in., and 71 in. by 54 in., with new boilers working at 170 lbs. pressure of steam. The engines for the foregoing vessels are constructed to work at 160 lbs. pressure of steam, with the exception of those for the two "Gulf" line vessels, which work at 170 lbs. pressure. Messrs. Blair & Co. have just fitted the s.s. *Gulf of Ancud* with a complete electric lighting installation of 82 lamps of 16 C.P. each, including mast head, side, and portable deck lights.

Middlesbro'.—At this centre there is little change from the state of affairs which was noted last month, work in the shipbuilding yards being still fairly brisk, and activity continuing to be the feature at the steel works and foundries. Messrs. Harkess & Sons are preparing to launch a vessel of 1,000 tons burden next spring tides, and have a large vessel belonging to a local firm on the slipway undergoing a thorough overhaul.

Darlington.—The Darlington Forge Co., Limited, have recently booked an order for a triple steel crank shaft, weighing about 29 tons, for a National liner, now building on the Tyne, and have also within the last few days secured orders for eight heavy cast-steel stern frames, six of which were received from one firm alone. Each of the latter, it may be stated, are to weigh, when completed, between 10 and 12 tons.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—There is still very considerable activity at local shipbuilding works, and the progress which is being made with the orders in hand is such as will show great tonnage returns for the present year. The *Latona*, H.M. cruiser, is receiving her fittings at the Devonshire Dock, under the 100-ton crane, at the yard of the Naval Construction of Armaments Co., and has already received her two masts and a part of her rigging. The *Melampus* will be the next cruiser launched, to be followed by the *Naid*. Both of these cruisers are in a forward state, and there will soon be room in the yards for other work. Much progress is also being made with the three gigantic steamers for the Canadian Pacific Railway Co., which are intended for the Pacific station between Vancouver and Yokohama. The first of these steamers will soon be launched. The second one is well forward in plating and the third is well in frame. There is not at present any new work in progress at Barrow, but it is reported there is a fair inquiry for the general cargo-carrying vessels. The better class of work, however, is wanted at Barrow, where facilities exist for the erection of the largest and fastest class of vessels. It is confidently expected that some good orders will soon be placed at Barrow, especially now that the price of steel is materially coming down to a point which will enable builders to quote much lower prices for the building of new tonnage. Plates are quoted at £6 15s., angles at £6 5s., and steel boiler plates at £10 per ton. It is interesting to note there is plenty of repair work going on, and that the work of furnishing triple-expansion engines and new boilers to old steamers is on a comparatively large scale, and likely to remain so. The works of the Graving Dock Shipyard at Barrow still remain idle, and there is no immediate prospect of a sale to a new company.

Whitehaven.—The Whitehaven Shipyard remains idle, and now that the shipbuilding trade is quieter in tone, the directors who are looking out for a purchaser have no immediate hopes of finding one.

Workington.—The blacksmiths at Messrs. Williamson & Son's shipyard, who came out on strike some weeks ago against a reduction of wages, have returned to their work at the former rate of wages. The firm are busy with the repairing of the steamer *Scale Force*, which was damaged by stranding at Harrington; and they have a ship which is nearly half plated, as well as a coasting steamer in frame.

THE MERSEY.

A CONTINUED slackening off in all branches of the shipbuilding trade is reported throughout this district; contracts are rapidly running out without being replaced, and there is every indication of approaching stagnation so far as shipbuilding and the various directly allied branches of industry are concerned. Outside shipbuilding and marine engineering it can scarcely be said, however, that any really appreciable decrease of activity is as yet being felt. In some departments, it is true, firms are only being kept busy with orders they have had for some time on their books, and are receiving very little new work, but in many branches, such as special machine tool making, stationary engine building, boiler making for inland requirements, and in some departments of railway work, such as constructive material for extensions and the manufacture of rolling stock, there is still no actual scarcity of new work coming forward. All this necessarily tends to keep labour in a buoyant condition, and the returns of the engineering trades unions' organisations show little or no increase in the number of unemployed members on their books, the percentage in receipt of out-of-work support still remaining unexceptionally low. The Amalgamated Society of Engineers have barely 2 per cent., and in this immediate district only about 1½ per cent., whilst the Steam Engine Makers' Society has scarcely more than ½ per cent. of its total membership in receipt of donation benefit. These societies are only to a partial extent dependent upon shipbuilding, and as marine engineers in most cases are still fairly busy finishing work, they are necessarily not as yet appreciably touched by the lessened activity in the shipyards. The Iron Shipbuilders and Boiler Makers' Society, however, is beginning to feel the effects of the falling trade in the shipyards; the activity which still prevails in the inland boiler trade of course keeps one important section of its members well employed, but so far as marine boiler making and iron shipbuilding are concerned the returns of unemployed members are beginning to show a very perceptible increase, and, unless new orders are very speedily secured in the shipbuilding yards and marine boiler-making shops, the society is looking forward before long to a very considerable increase in the number of members coming upon the books for out-of-work support. At present the percentage of members even amongst marine boiler-makers in receipt of donation benefit is comparatively small, but this position of affairs it is evident cannot be very long maintained. In spite, however, of all the too evident indications of the general falling trade workmen show no disposition whatever to abate in the slightest degree the extravagant demands which they have been enabled to force upon the employers during the spurt of activity which has prevailed until very recently. The price of material, both raw and manufactured, has it is true fallen very considerably during the last month or so, but this of itself is not sufficient to place employers in a position to quote prices that will enable them to secure new work, and the prospect before them is that as their present contracts run out they will be compelled to gradually close their establishments and allow the workmen to go on the funds of their respective societies for support, until they are brought to a more reasonable frame of mind, and prepared to submit to such rates of wages as the altered condition of trade will only justify.

Visits to the various shipyards on both sides of the Mersey show no very appreciably altered condition of things compared with what was reported last month. The outlook is becoming less satisfactory as work in hand is gradually completed without being replaced. The large shipbuilding yards of Messrs. Laird & Co., of Birkenhead, are still kept fully employed with the important contracts they have in hand, and upon these steady progress is being made. They have now fairly commenced upon the large line-of-battle ship, the starting of operations upon which were somewhat delayed by the necessary enlargement of the dock in which she is now being built, but the keel has now been laid and a portion of the framework put up. The *City of Paris* is still lying in the hands of Messrs Laird & Co., who carried out the necessary work to prepare her for the Board of Trade inquiry which has just been held, and it may be of interest to mention that it was not until Messrs. Laird began to remove out the damaged machinery that the discovery was made of the broken shaft, and until this fell out of the ship in dock no idea was entertained that the breaking of the shaft had been the direct cause of the wreckage of the engine-room. It is probable that the *City of Paris* will remain at the Birkenhead dock until the builders at Glasgow to whom she is being sent can take her in hand to make the necessary repairs. At the yards on the Liverpool side of the Mersey the vessels in hand are being gradually completed, the *Gorgon*, built by Messrs. W. H. Potter & Sons, and the *Saladin*, by Messrs. Royden & Sons, having been sent on their trial trips during the past fortnight, and both vessels satisfactorily fulfilled their requirements in all respects. Neither of these firms report any new work coming forward, and there are even comparatively very few invitations to tender. In fact, new vessels would now only be placed out at prices which shipbuilders with the present rate of wages could not attempt to touch, and until the workmen will consent to recognise the altered condition of things the determination on the part of the employers is to discharge the men as work runs out, and eventually, if necessary, close their yards entirely until the men are induced to listen to something like reason. Of course, they are placed in a somewhat difficult position by the fact that at Birkenhead Messrs. Laird & Co. are likely to be busy for the next two or three years, and whilst this is the case the activity at the Birkenhead yards will be fully taken advantage of by the men to prevent any reduction in wages, as no doubt any attempt on the part of Messrs. Laird to bring about a reduction would be followed by a strike on the part of the men, which with the important contracts they have in hand could scarcely be allowed. The position of the men is also further strengthened by the activity, which as already reported prevails in other sections of engineering, and the prospect is that, at any rate for the remainder of the present year, employers can scarcely hope to bring about any appreciable lowering in the rate of wages, and they will have to be content to either remain without new orders or to accept them at terms which can scarcely be remunerative to themselves. Amongst marine engineers very much the same state of things prevails. They are finishing the engines and fittings for vessels which are not yet completed, but they are getting little or no new work, and where they have prospects of being kept busy it is chiefly upon foreign work outside of marine engineering.

Very satisfactory progress is being made with the work of constructing the Manchester Ship Canal on all the various erections along the route from Eastham to Manchester. At Eastham one of the large lock gates is now being erected. These gates are being constructed of greenheart, and the weight of each leaf finished will be about 250 tons. Operations have also commenced for constructing the sluices by the side of the locks. These are Stoney's patent roller sluices, and are being manufactured by Messrs. Ransome and Rapier, of Ipswich. At Ellesmere Port Bay a large number of the piles have been driven. At Runcorn considerable progress has been made in the construction of the locks and the continuation of the river wall, and in connection with this work it may be mentioned that the dams are being driven in the river. In connection with the large viaduct at Moor Lane, the steel super-structure of the large swing bridge, which is being built by Sir William Arroll, is now being erected. The viaduct for the railway diversion at Acton Grange is in course of construction, and this work is progressing very rapidly; the buttresses are being built of huge blocks of red sandstone, and some of the ironwork is already on the ground. At the next point on the same diversion the viaduct piles have been driven in the river for the erection of the iron work from the abutments which are now nearly clear. At Latchford, where there is another railway diversion, the piers for the viaduct are at least 30 ft. above the surface of the road, and wholly built of brick, faced with Staffordshire blue bricks, which gives a handsome finished appearance to the work. The next point of interest are the Latchford locks. The iron work in connection with these is being put in, and considerable progress is being made with the concreting of the lock walls. At Warburton the work is also well advanced, and in connection with the Cheshire Lines diversion at Glazebrook all the piers are rapidly approaching completion for the erection of the viaduct, whilst for the diversion over the River Irwell the workmen are now busy on the erection of the piers. In connection with the diversion of the Liverpool section of the Cheshire lines, all the piers are now up to the spring of the arches. At Irlam the locks are well advanced, and at Barton, where a diversion of the river is being carried out, a couple of tunnels are being cut through, and these are approaching completion, whilst preparations are being made for commencing the new swing aqueduct, which will form one of the chief engineering features in connection with the undertaking. The Mode Wheel locks are in an advanced condition, and the gates are being built at the Salford sheds, which are now quite full of various parts of the work in forward stage of completion. The Manchester and Salford docks are in a very advanced state, and the coping is now finished on a considerable part of the walls. In connection with the Manchester and Salford docks, a large swing bridge will be erected for carrying over the Trafford Road. This bridge will be 46ft. wide, and the dead turning weight will be just under 2,000 tons. The foundations for this bridge are now being laid, and the work generally in connection with the Manchester and Salford end is progressing very satisfactorily.

A simple but at the same time a very effective smoke burner has been introduced by Mr. William McGuffin Greaves, of Fountain Street, Manchester, and trial tests with boilers fitted with his patented arrangement were made at the Egret Mills, Ashton-under-Lyne, last week. The principle of these smoke burners is to raise the temperature in the furnace to a sufficient height to ensure the perfect consumption of all the products of combustion from the fuel. This is effected by introducing a series of two or three blocks in the form of arches, one above the other, which are placed upon the top of the bridge at the back of the furnace. The blocks are composed of a material, the preparation of which is a special patent, but it may be described as a kind of asbestos substitute, the chief qualities of which are that it is an almost perfect non-conductor of heat, whilst it is indestructible, or nearly so, under incandescent heat, and the alternations of heat to which it is subjected when it is placed in the furnace. The heat from the furnace quickly renders these blocks incandescent, and maintains them so, whilst to ensure an adequate supply of atmospheric air in addition to what is admitted through the furnace doors and bars, a curved and perforated plate is introduced on the back of the furnace, and immediately in front of the bridge. By this arrangement all the smoke emitted from the fuel has to pass over or between the surfaces of the arches formed by the combustion blocks, and these being in a state of incandescent heat, all the carbon which is contained is consumed as the smoke passes in thin streams through the combustion blocks on its way to the chimney. The tests made with this smoke burner were satisfactory in every respect, the only appearance of black smoke being momentarily during the stoking of the furnace, this arising from the temporary chilling of the combustion blocks by the admission of cold air through the open furnace door, but with mechanical stoking, which would not necessitate any opening of the doors, the emission of black smoke would be effectually prevented. This appliance has a further advantage in addition to being an efficient smoke consumer. By its use a considerable saving of fuel is effected, which it is claimed is at least from 15 to 20 per cent. Further than this, by the combustion of the smoke the draught in the furnace is increased, causing a more perfect combustion of fuel, whilst the absence of smoke also keeps the pipes of fuel economisers always clean, and the water they contain is raised to a much higher temperature. A number of these smoke preventers have already been supplied to works in the district, in all cases eliciting the highest testimonials as to their efficiency, both as smoke burners and fuel economisers, and the simplicity of their arrangement obviously renders them easily applicable to marine boilers, where they would be found a very great advantage, especially upon steamships which have to travel over inland waters.

In the iron market there has been a steadier tone during the latter portion of the past month, and although trade still remains without any appreciable actual improvement, a more cheerful tone prevails, and where buyers have requirements to cover there has been less hesitation in placing out orders. For pig iron there have been some very fair enquiries stirring and a moderate amount of business has been done, whilst offers for considerable quantities have been declined, owing to makers not being disposed to accept the prices which buyers were prepared to give. Where business has been done it has been upon the basis of about 44s. 6d. and 45s. for Lincolnshire forge iron, and 46s. to 46s. 6d. for foundry qualities, less 2½ delivered equal to Manchester, but local and district brands, such as Lincolnshire and Derbyshire, are still quite out of the market at the prices which makers have been quoting. In outside brands some fair transactions have taken place in good foundry brands of Middlesbro' at about 50s. 10d. to 51s. 4d. net cash, delivered equal to Manchester, and in Scotch iron Eglinton has been sold at 54s. 6d. and Glengarnock at 59s. 6d. net cash, delivered in the Manchester district.

The manufactured iron trade remains in a depressed condition with prices weak and irregular. Merchants have perhaps been getting more enquiries, but makers are still very much in want of specifications to keep works going, and ready to accept under their list rates to secure orders. Lancashire bars do not average more than £6 10s., and North Staffordshire qualities £6 17s. 6d., with local made hoops quoted at £6 12s. to £6 15s., and sheets £7 10s. to £8 per ton, delivered in the Manchester district.

The steel trade does not at all share even in the slight improvement which has taken place in the iron market. Although the further restriction of the output tends to stiffen the price of hematites, there is very little buying going on, and this only at low figures, good foundry qualities taken out of store being obtainable at 61s. 6d. to 62s., with makers willing to accept 63s. to 63s. 6d. delivered in the Manchester district. So far as steel plates are concerned there is an almost complete collapse in prices. The absence of any further orders given out for shipbuilding requirements seems to have created quite a scare on the part of manufacturers, and there is an anxiety to secure business at almost any figure, prices being quite 20s. per ton below those quoted last month. In fact, it would be difficult to say at what figure anything like a decent specification could now be placed. There is little doubt that for a considerable order steel ship plates delivered ex-steamer Liverpool could be placed at as low as £6 15s. per ton, whilst for the best qualities of steel boiler plates makers would now accept £8 2s. 6d. to £8 5s., and sales have been made at as low as £7 10s. to £8 per ton for delivery to consumers in the neighbourhood of Manchester.

In the metal market the upward movement in raw material, for which no definite reason can be assigned, has had the effect of bringing about an advance of a farthing per lb. on all descriptions of manufactured goods, and for delivery equal to Manchester and Liverpool quotations are now as under:—Brass wire, 7¼d.; copper wire, 9d.; rolled brass, 7⅜d.; solid drawn brass locomotive tubes, 7¾d.; brass condenser tubes, 8¾d.; solid drawn copper tubes, 9⅜d.; braized copper tubes, 9⅛d.; and braized brass tubes, 9¼d. This advance has, however, not been due to any increased demand for manufactured goods, but has tended rather to check buying. Manufacturers, however, are holding firmly for the present to their full list rates.

In the timber trade imports have been moderate, but business continues very unsatisfactory, and most articles have declined in value. The deliveries have been fair, but much has been forced off at unremunerative rates to make room for new imports. Stocks are still too heavy, and it is evident that if a further decline in prices is to be prevented shipments must be kept very moderate.

The coal trade has been very quiet during the past month, and there is a decided easing down in prices, the common descriptions for steam purposes being now offered at very low figures. At the pit mouth common steam coal might in some instances be bought at slightly under 8s. per ton, whilst 8s. to 8s. 6d. represent the full average prices. For delivery at the High Level, Liverpool, or the Garston Docks, good ordinary qualities of steam coal could be readily bought at 9s. 6d. to 9s. 9d. per ton, and in some instances at even less.

WELSH NOTES.

LABOUR agitations have been very much the fashion in South Wales since our last issue. So far the agitators have confined their attention to Swansea, but they promise to speedily visit Cardiff and Newport. At Swansea Messrs. Ben Tillett & Co. had their hands very full. The men were quite prepared to strike, but when it came to a question of resuming work on terms which their leaders assured them were the best possible, great friction arose. Tillett, it is only fair to admit, was as fair as he possibly could be, and did not hesitate to talk even very plainly, and it was due to this plain speaking, and a threat that the men would be left in the lurch by the Union unless they did as they were told, that the more unruly sections obeyed orders. Not the least amusing incident in connection with the strike was the loading of the s.s. *Goldcliffe* by merchants, shipbrokers and their clerks at Graigola Wharf. The amateurs succeeded in loading some 400 tons in ten hours, which was not so bad considering that none of them knew a single thing about the business. Needless to say the strikers, with their sisters and their cousins and their aunts, formed a chaffing, but good tempered audience.

Kenny's Union, in which the Swansea coal trimmers are enrolled, has also been to the front and succeeded in its object of doing away with the middle man. Henceforth the men will receive exactly what merchants pay; hitherto the foremen have been making all the profit.

The Unions chose a very good time for their agitation—the week before the men went out the trade of the port beat the record by some 10,000 tons, and the few days' idleness glutted the docks with tonnage, and had the effect of stopping several collieries whose waggons could not be emptied on account of the delay in discharging steamers at the docks.

A rumour gained currency at Newport in the early part of the month to the effect that the Board of Customs intended to do away with a collector at the port named, and arrange for all the principal business to be transacted from Cardiff. The Chamber of Commerce took up the matter with the result that the report has been officially contradicted.

For May the coal trade of Newport showed a decrease of 10·63 per cent., of Cardiff 15·93 per cent., Penarth, 15·07; Swansea showed an increase of 3·58 per cent.

As we suggested would be the case in an article which appeared in these columns some time since on the port of Cardiff, the Bute authorities are seeking to make up for the coal trade taken from them by Barry, by cultivating an import trade. The imports range from cattle and grain to fruit and brandy. There is a splendid opening in this particular direction for Cardiff, and Sir Wm. T. Lewis appears determined to take every advantage of it.

We understand that during the past week one of the promoters of the new line of steamers between France and Swansea, to which we referred some time since, visited the latter place to make arrangements for the erection of the necessary sheds, &c.

There is some chance of Port Talbot becoming something more than what it is now—a splendid property neglected. A few days since several railway companies made overtures to the present proprietors with a view of securing the dock estate. One at least of the companies concerned would certainly change the prospect of the place very materially, and in attempting to secure it are, it appears to us, possessed of an idea of very materially changing present railway arrangements in South Wales. At the moment we cannot say anything more definite as to the possible arrangements, but it is very certain that if Port Talbot be really taken in hand by a good company, Swansea will suffer.

Since our last, the secretary of the Rhimney Iron company has sent a circular to the shareholders, saying that the profits of the company up to the end of March last were sufficient to permit of a 2½ per cent. for the year. An interim dividend of ½ per cent. was paid in February, so that the fortunate mortals who have money in this undertaking will receive 3 per cent. for a period during which the iron trade was exceedingly prosperous. Whatever is the matter with the concern?

John Bland & Co., Limited, the Cardiff timber people, have just paid a dividend for the half-year of 5½ per cent. The interim dividend in this case was 2½ per cent., so that the shareholders receive 8 per cent. for their money. Yet the timber trade has been in a far from prosperous state. That there should be so much difference in the returns made to their shareholders by the two companies is perhaps due to the fact that the managing director of Bland's knows his business, whilst, judging from the Rhimney returns, one would be quite justified in thinking that not a single man on the board knew anything about iron.

The profits of the Ebbw Vale Co., for the 12 months ending March 31st., were £27,346, and of which thedirectors recommend a dividend at the rate of 7s. per share. Again a wretched result.

Shipowners in Cardiff are following the example of the north country owners and lying up their ships. The newer ships can still do some good, but for the old ones there is no chance of profit at the present wretched rates. Why do not shipowners take the present opportunity, when it is really better policy to have their ships idle than trading, to start a crusade against the iniquitous terms of Welsh charter parties?—there is almost a dividend in the extra price paid by the owner to the charterer on his bunker coal. As things are just now the shipowner is practically paying coal shippers a premium for the privilege of losing money.

BELFAST TRADE NOTES.

BOTH the shipbuilding and engineering trades continue fairly busy, and there are no empty stocks in any of the yards. Although there is no immediate prospect of dulness, workmen are much more plentiful and are easier to deal with than they were some months ago. Messrs. Harland & Wolff are still working a night shift in their engine department in order to keep pace with their work, and they are adding 100 ft. to their magnificent fitting and erecting shop.

Messrs. McIlwaine & Maccoll had a successful trial trip of the s.s. *Strait Fisher*, an account of which will be found in another column.

They have received an order from Samuel Lowther to build two steel screw steamers of 750 tons burthen, to be fitted with all the most approved appliances for loading and discharging cargo. They will be the pioneers of a new line to be opened by him between Belfast and Liverpool, and as the trade between Liverpool and Belfast has been steadily improving, and it is believed will receive a great impetus on the opening of the Manchester Canal, there is every reason to believe that there is a prosperous future before the new line.

They have almost ready for launching a fine steamer to the order of the Antrim Iron Ore Co., and which will be fitted with a set of triple-expansion engines which have Hackworth's patent valve gear, the great advantage of which is a quick cut off, the cards taken off engines fitted with this gear giving very good figures.

Messrs. V. Coates & Co. had in hand during the past month the s.s. *Caloric*, Belfast and Liverpool line, for overhaul and Board of Trade survey; also the s.s. *Ferrie*.

Messrs. Workman, Clark & Co. will have some launches shortly.

The Harbour Commissioners are now making additions to the sheds at the Dufferin Dock to accommodate the increasing trade.

The steam tug *Flying Foam* has, we understand, been chartered by the Board of Irish Lights to act as a tender during the repairs of the Fastnet Lighthouse, which was seriously damaged during the late storm.

LEITH NOTES.

WORK during the last month has been rather slack, and orders are scarce, several firms being forced to reduce their staffs. At present, however, two steamers are being built here for Messrs. James Currie & Co.'s fleet, one of which by Messrs. Ramage & Ferguson, and the other by Messrs. S. & H. Morton & Co.; and some repairing is still in hand.

On the 31st May the new steel screw steamer *George Dumois*, launched by the Grangemouth Dockyard Co. from their yard at Alloa, went her trial trip, attaining a speed of 12 knots, or considerably over the guaranteed speed. She is built to the order of Messrs. S. M. Kuhnle & Son, Bergen, and has been specially designed and built for the fruit trade between the West Indies and New York. The engines were supplied by Messrs. Hutson & Corbett, of Glasgow.

On the same date the s.s. *Moss Rose*, built by the same firm, also went her trial trip. The *Moss Rose* is engined by Messrs. Hutson & Corbett with compound surface condensing, the cylinders being 20 and 40 by 30 in., and is the latest addition to the coasting fleet of steamers owned by Messrs. Richard Hughes & Co., Liverpool. She attained a speed of 11¾ knots.

On 4th June, the same firm launched from their building yard at Kellie Bank, Alloa, a fine steel barge, built to the highest class at Lloyd's, and of the following dimensions:—Length, 280 ft.; breadth, 27½ ft.; depth of hold, 21 ft. The vessel, which is 1,400 tons register, was named the *Danube*.

On the same date Messrs. Hawthorns & Co., Leith, launched a steam trawler, to the order of Mr. J. Devlin, junr. She was named the *Commodore*, and is of 54 N.H.P.; length 100 ft.

On the 13th June, the Grangemouth Dockyard Co. launched from their yard at Grangemouth a handsomely-modelled steel screw steamer, built to the order of the Jessie Steamship Co., Limited, of Dundalk. Dimensions as follows:—158 ft. over all, by 24 ft. by 11½ ft. depth, and she is classed 100 A1 at Lloyd's, under their special survey. She is fitted with Clark, Chapman's winches, Fisher's windlass, driven by messenger chain, steam steering gear by Messrs. Alley & McLellan, Glasgow, having raised quarter-deck, bridge-house, and top-gallant forecastle. Her deadweight capacity is 400 tons, her engines being compound surface condensing, by Messrs. Hutson & Corbett, of Glasgow. She was named the *Jessie*, and is the pioneer steamer owned in Dundalk.

On June 18th, Messrs. Marr Brothers launched a wooden steam trawler to the order of Messrs. MacKay & Co., Leith. She was named the *May Queen*, was built to Lloyd's pressure survey, and her dimensions are:—Length, 100 ft.; depth, 21 ft.; breadth, 10½ ft. She will be engined by Messrs. Hawthorns & Co.

On the same date the magnificent steamer *Talune*, recently built by Messrs. Ramage & Ferguson to the order of Tasmania Steam Navigation Co., went on her trial trip. Her dimensions are:—280 ft. by 38 ft. beam, gross register, 1,992 tons. She is schooner rigged, is fitted with triple-expansion engines, and works to a pressure of 2,044 H.P., and is intended for passenger and general goods traffic between Tasmania and Melbourne and Sydney, and is beautifully fitted up. The dining saloon is made of solid oak and maple, the decks are of teak, which withstand a hot climate, and the electric light is diffused by 200 lamps.

We understand that Messrs. Durham, Churchill & Co., of Leadenhall Street, London, have been favoured with an order for two marine engine governors for the *Polar Star*, the new yacht built for His Imperial Majesty The Tzar of Russia. They have also on hand two governors and compound attachments for the new Russian ironclad *Asof*, a vessel of 11,500 I.H.P.

THE ACCIDENT TO THE "CITY OF ROME."—On June 25th, judgment was delivered by the Liverpool stipendiary, with whom were Captains Methven and Kennett Hoare as nautical assessors, in the case of the steamship *City of Rome*, which struck the Fastnet Rock, while on a voyage from New York to Liverpool. Mr. Mansell Jones, instructed by Mr. Paxton, of Liverpool, appeared for the Board of Trade, and Mr. Baden-Powell, instructed by Mr. George Dickinson, represented Captain Hugh Young, the master of the vessel. The magistrate said that proper measures were taken by the master to ascertain the errors in his compasses from time to time. He appeared to have regulated his speed according to the exigencies of the weather. The cause of the casualty was the failure of the master to use sufficient judgment in applying the warnings given by the lead. With the exceptions noted, in the judgment of the Court they thought that the vessel was navigated with proper and seamanlike care. There was no proof that the *City of Rome* was racing with the *Aurania* or any other vessel. From the evidence given by the witness from the Fastnet lighthouse and the register produced by him, the explosive signals appeared to have been fired at regular intervals. The Court had already pointed out in the judgment where the master was in error, but the errors in their opinion were errors of judgment. The Court did not, therefore, deal with his certificate. The officers were in no way to blame.

HARTMANN'S RAHTJEN'S COMPOSITION.—We have received a copy of a new circular issued by the Suter Hartmann & Rahtjen's Composition Co., Limited, from which some very useful information on the treatment of steel and iron vessels may be obtained. Their composition for protecting the bottoms of these vessels seems to hold its own against all comers, notwithstanding the large number of imitations it has to contend with. Although apparently more costly than other compounds for similar purposes, its hard and smooth surface, which minimises the skin friction on the hull, and its long period of freedom from fouling makes it the most economical. The advantages of building steamers of mild steel has for the last few years been fully recognised, but the difficulty of protecting this material from rust and corrosion has been very much felt from the outset, and at last has created, in all those interested, a serious apprehension as to how it could be overcome. The failure of attempts to obtain a thorough protection of steel is in a great measure accounted for partly by the use of the same protectives as are mostly used for ordinary iron, whereas steel requires a composition which ought not only to protect it against atmospheric influences, but also counteract the chemical alterations steel is peculiarly subject to under the trying climatic and other influences incident to the interior of a ship. This company claims for their *Hartmann's grey paint* the merit of meeting and overcoming this difficulty, and if its use by the extensive list of the principal shipping companies which they give in their circular goes for anything, it seems to possess the merit it claims. We commend a perusal of this circular to all those interested in preserving the life of steel-built steamers.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Fleur de Lys.—On May 24th there was launched from the yard of Messrs. T. G. Tagg & Son, at East Molesey, a steam yacht—the *Fleur de Lys*—which claims notice from the fact of its being one of the largest craft built on that part of the river Thames. This vessel, which has been built for Colonel P. E. Pope, has a gross tonnage of 26·06 tons, and is 70 ft. long by 10 ft. 6 in. beam, and 6 ft. deep. She is teak built, and her draught forward is 3 ft., and aft 4 ft. 9 in. She will be fitted with triple-expansion condensing engines of 95 H.P. indicated, having cylinders 6 in., 9 in., and 15 in. in diameter respectively, with a 10-in. stroke. The engines will take steam from a steel return-tube boiler at 150 lbs. pressure. Her coal bunkers have a capacity of three tons, and her speed is to be 12 miles per hour. The *Fleur de Lys* is fitted with two spacious cabins, one forward and the other aft. She will be steered from amidships, and driven by a three-bladed screw propeller. She is altogether a very well built craft, and does her builders great credit.

Composite Lightships.—On May 30th Messrs. R. & H. Green launched the second of two composite lightships they have on order for the Trinity House Corporation. The vessel was built from the designs of Mr. F. C. Goodall, the naval architect to the Corporation. The fittings are generally of teak, of which a liberal use is made; the decks, however, are of elm planking. Special provision is made for ships' stores and the carrying of explosives, an allowance of which becomes necessary in the vessel. It is proposed to use a flashing-power of 20,000 candles in the lamps to be employed. These will be of 60 candle-power each, and placed in an 8 ft. cylindrical lantern, the reflector being 21 in. diameter. The fog signal siren will be worked by a steam motor to compress air in a reservoir from which to draw its supply. Provision is thus made for starting the signal at any moment. The machinery for this purpose is fitted in duplicate in case of breakdown.

Ionic and Jutassic.—On June 3rd Earle's Shipbuilding & Engineering Co., Limited, launched from their yard at Hull two iron steam trawlers, 100 ft. long, by 20 ft. 6 in. beam, by 10 ft. 9 in. depth of hold, named respectively *Ionic* and *Jutassic*, and built for the Grimsby Steam Fishing Co. to Lloyd's 100 A class with necessary excesses of scantlings in desirable parts. The builders will fit them with their special steam trawling winches, and also with triple-compound engines having cylinders 12¾ in., 20 in., and 32 in. diameter by 22 in. stroke, supplied with steam by a steel boiler of ample size to work at 150 lbs. steam pressure. These are sister ships to the s.s. *Gaelic* and *Hellenic*, launched a week or two ago, and the former of which went on her trial trip on the 29th ult., averaging 10 knots on the measured mile in a very choppy sea.

Yalin.—On June 3rd this vessel was successfully launched from the yard of Messrs. Wm. Doxford & Sons, at Pallion. She has been built to the order of Messrs. A. d'Orbigny & Faustin Fils, of La Rochelle, France, is entirely of steel and built to Lloyd's 100 A1 class. The principal dimensions are:—Length between perpendiculars, 250 ft.; breadth extreme, 35 ft.; depth, moulded, 18 ft. 6 in., with cellular bottom fore and aft. The engines are triple-expansion three cranks, by Messrs. Doxford, with all the latest improvements, the cylinders being 21 in., 33 in., 54 in. by 36 in. stroke, and they are supplied with high-pressure steam from very large boilers. She is fitted with Bow, McLachlan's patent steam steering gear, screw gear aft, and 4 ft. 6 in. by 10 in. steam winches, by Welford Bros., of Pallion, with the latest improvements for cargo purposes. This vessel is in every respect a duplicate of the *Reaumur*, recently launched by Messrs. Doxford for the same owners, which now makes their fleet number fourteen vessels. This vessel also has been under the supervision of the company's inspectors, Captain Plissou and Mous. Les-ansse, the former looking after the ship, while the latter superintended the engines. The christening ceremony was gracefully performed by Mrs. Chas. Doxford.

Victorina R.—On June 3rd Messrs. Cox & Co., Falmouth, launched the s s. *Victorina R*, being the first of two duplicate boats specially building for the execution of a Government contract in South America. The vessel is constructed of steel throughout, under Lloyd's special survey for the 100 A1 class. Her dimensions are:—95 ft. long by 18 ft. 6 in. beam by 10 ft. deep. Passenger accommodation is fitted under raised quarter-deck; the officers' and crew's quarters are placed forward of the machinery space. A roomy steering bridge, supported at sides and centre from deck-houses, is fitted forward of funnel. Towing gear is provided. The engines are triple-expansion, surface condensing, to indicate 320 H.P. Steam at 150 lbs. working pressure is supplied from a large steel boiler fitted with two spirally-corrugated furnaces.

Largo Bay.—On June 3rd there was launched from the shipbuilding-yard of Messrs. R. & W. Hawthorn, Leslie & Co., Limited, at Hebburn Quay-on-the-Tyne, a steel screw steamer, built to the order of Messrs. W. J. Affleck & partners, North Shields. Her dimensions are as follows:—Length over all, 298 ft.; breadth, 37 ft.; depth, moulded, 24 ft. 7 in. The engines will be supplied by Messrs. Westgarth, English & Co., of Middlesbrough. They are to be triple-expansion, and 200 N.H.P. The vessel was named the *Largo Bay*.

Rangatira.—On June 4th Messrs. W. Gray & Co., Limited, launched from their yard at West Hartlepool a large steel screw steamer which has been built to the order of Christopher Furness, Esq., of this port, for Messrs. Shaw, Saville & Co., of London. The vessel will take Lloyd's highest class, and the dimensions are:—Length, over all, 376 ft. 6 in.; breadth, 47 ft.; depth, 29 ft. 4 in. The deck erections consist of a poop, bridge, and forecastle. Two complete iron decks are laid, and inway of the holds the web-frame system of construction has been adopted, and a cellular double bottom is fitted throughout the ship for water ballast. The saloon, captain and officers' accommodation, &c., will be tastefully fitted up in the poop, the engineers' accommodation amidships, and the crew's berths forward. The arrangements for working the ship and handling cargo will be of the most efficient description, including patent direct steam windlass, by Emerson, Walker & Co., steam steering gear, 6 steam winches, &c. A considerable portion of the ship will be insulated for carrying frozen meat from New Zealand, and two powerful refrigerators will be fitted in the 'tween decks. Fine triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. The cylinders are 27 in., 43 in., and 72 in. diameter, with a piston stroke of 45 in. The boilers are of the double-ended type and are designed for a working pressure of 160 lbs. per square in. The ceremony of naming the ship *Rangatira* was gracefully performed by Miss K. Casebourne, of Greatham. This is the largest ship ever built at the port, having a deadweight carrying capacity of about 6,250 tons. We understand Mr. Furness has another ship building by Messrs. W. Gray & Co., Limited, of the same dimensions and carrying capacity.

Archee.—On June 4th Messrs. Forrestt & Son launched from their Wyvenhoe Shipyard the new five-rater cutter, built by them for Mr. John McNiah, from the design of Mr. G. L. Watson. As the yacht left the ways she was named the *Archee* by Miss Annie Lawton. This yacht is expected to be a very strong opponent of the yachts sailing in her class this season

Lincoln.—On June 4th Messrs. Robert Thompson & Sons launched from their Bridge Dockyard, Sunderland, a handsomely-modelled iron screw steam trawler, built to the order of Mr. Wm. Liddall, of London. Her dimensions are as follows:—Length between perpendiculars, 95 ft.; breadth, 20 ft. 3 in.; depth to top of floors, 10 ft. 6 in. The vessel has been built to class 100 A 1 at Lloyd's under special survey. She has cabin fitted aft for captain and officers, forecastle fitted forward for crew, and three watertight bulkheads, and is provided with all the latest improvements for deep-sea fishing. She will have compound surface-condensing engines, with steel boiler by the Northern Marine Engineering Co., South Shields. The hull and engines during their construction have been under the superintendence of Mr. J. Ferguson. The vessel was named the *Lincoln* as she left the ways, the ceremony being performed by Miss Annie Manson.

Adriatico.—On June 4th there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son, at Sunderland, a screw steamer, constructed of Siemens-Martin steel, to class 100 A; tonnage about 1,350 gross. She will be fitted with triple-expansion machinery, of 800 I.H.P., by the North-Eastern Marine Engineering Co., Limited. The vessel has been built to the order of Messrs. Eredi C. cav Gerolimich & Co., of Lussinpiccolo. The vessel was named the *Adriatico*.

Forest Holme.—On June 5th a new screw steamer, built of steel, to the order of Messrs. Hine Bros., was launched from the yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland, and was named by Miss Laura Dickinson, of Sunderland, the *Forest Holme.* The vessel has been built under Lloyd's special survey, taking the 100 A 1 or highest class at Lloyd's. Her principal dimensions are as follows:—Length, over all, 313 ft. 3 in.; breadth, 39 ft.; depth, moulded, 21 ft. 5 in.; and she will carry 3,400 tons on 20¼ ft. draught of water. The engines and boilers are by the firm of John Dickinson, Palmer's Hill Engine Works, Sunderland, and are tri-compound, surface-condensing, with cylinders of 22 in., 36 in., and 59 in. diameter respectively, and 39-in. stroke. There are two steel main boilers (as well as cargo boiler) tested to a pressure of 320 lbs. per square inch, and the vessel is expected to steam 9½ knots on a consumption of about 15 tons per day.

Isabel.—On June 5th the ocean-going steam tug *Isabel*, built and engined by Messrs. Vosper & Co., Marine Engineers, Portsmouth, for Messrs. Watkins & Co., London, was most successfully launched from the builders' yard. She is of steel construction, fitted with triple-expansion engines of 400 I.H.P. Her principal dimensions are:—Length, between perpendiculars, 85 ft.; beam, 17 ft. 6 in.; depth, 10 ft. 6 in. The christening ceremony was performed by Miss Vosper. Messrs. Vosper & Co. also have in hand three sets of machinery for the War Department torpedo mining launches; an Admiralty steam launch complete for torpedo range work at Plymouth; a marine boiler for the Indian Government; a set of compound launch machinery for the Monte Video Gas Works; and a steam launch for Captain Willoughby, owner of the yacht *Corisar.*

Corea.—On June 7th the Blyth Shipbuilding Co., Limited, launched a well-decked screw steamer of about 2,600 tons, for Messrs. Stephens, Mawson & Goss, of Newport, Mon. This vessel, which is a sister ship to the *Crimea*, recently built for the same owners by the Blyth Shipbuilding Co., Limited, is built of steel and iron to Lloyd's highest class, and has web frames, cellular double bottom for water ballast, raised quarter-deck and long bridge extending from after end of engine-room to foreside of foremast. The leading dimensions of the vessel are as follows:—Length, 269 ft.; breadth, 36 ft. 6 in.; and depth, 19 ft. 3 in., and has been built to comply with the Board of Trade requirements for carrying grain. Accommodation for captain and officers is in a handsome cabin aft below the quarter-deck, and the engineers are suitably provided for in after-part of bridge, and the firemen and crew are berthed under the topgallant forecastle. The engines are of the triple-expansion type and will be fitted by the North-Eastern Engineering Co., Limited, of Wallsend, and she is fitted with Emerson, Walker & Co.'s direct acting windlass. As the vessel left the ways she was gracefully named the *Corea* by Mrs. Trotter, wife of Captain Trotter, of the s.s. *Prodano.* The company's new graving dock recently opened is at present kept well engaged, and already a number of vessels have been docked.

Isabel.—On June 16th there was launched by Messrs. R. Craggs & Sons, from their Castle Moat Shipyard, Stockton-on-Tees, a steel steamer of the following dimensions:—Length, 203 ft.; breadth, 30 ft.; and depth, moulded, 15 ft. 10¼ in. She will be fitted by Messrs. Shanks & Son, Arbroath, with triple-expansion engines having cylinders 16¼ in., 26 in., and 44 in. by 33-in. stroke, and has two good-sized boilers by the Central Marine Engine Works, West Hartlepool. She was christened *Isabel.*

Hossinee.—On June 16th Messrs. William Dobson & Co. launched from their shipbuilding yard a steel screw steamer, built to the order of Messrs. James M'Intosh & Co., Bombay and London, agents for the Bombay and Persian Steam Navigation Co., of Bombay. The dimensions of the vessel are 258 ft. long by 34 ft. beam and 24¼ ft. in depth. The machinery has been manufactured by Messrs. Alley & M'Lellan, of Glasgow. The vessel was named the *Hossinee.*

Kingsland.—On June 18th Messrs. W. Gray & Co., Limited, launched the thirteenth steamer they have built for Messrs. Watts, Ward & Co., of London. The new vessel is built of Siemens-Martin mild steel, and is of the following dimensions, viz.—Length over all, 280 ft.; breadth, 36 ft. 6 in., and depth, 21 ft., 6¼ in., and over 3,000 tons deadweight capacity. She will take Lloyd's highest class, and is built on the web-frame and intercostal stringer system, dispensing with hold beams and giving a clear hold for stowing bulky goods. The deck erections consist of a poop, with a handsome saloon and cabins, a raised quarter-deck, long bridge to fore hatch, and topgallant forecastle, with accommodation for crew. The outfit and equipment consist of all modern appliances for a first-class cargo steamer of her size, including patent direct steam windlass, four steam winches, hand and steam steering gear amidships, screw steering gear aft, two donkey boilers, large hatchways, boats on beams overhead, and cellular double bottom throughout for water ballast. The rig will be schooner with double fore topsail and topgallant sail. Triple-expansion engines working on three cranks, to develop 800 H.P., and two steel boilers to supply steam at a working pressure of 154 lbs. per square inch, are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. She was gracefully christened *Kingsland* by Miss Evelyn Appleby, of Greatham. The hull and machinery have been superintended during construction by Captain J. A. Hodgson and Mr. A. H. Alkin, respectively, on behalf of the owners.

Westward Ho.—On June 18th there was launched from the yard of Messrs. J. T. Eltringham & Co., South Shields, a screw steam trawler, built to the order of J. Sanderson & Partners. As the vessel left the ways she was named *Westward Ho* by Miss Sallie Sanderson. The engines will be put in by Messrs. Baird & Barnsley, North Shields.

Geestemunde.—On June 18th Messrs. Sir W. G. Armstrong, Mitchell & Co., launched from their Walker shipyard, on the Tyne, a steel tank screw steamer, built to the order of Die Deutsch-Amerikanische Petroleum Gesellschaft, Bremen. The vessel is capable of carrying about 4,000 tons, and was named *Geestemunde.* Immediately after the launch the *Geestemunde* was taken to the works of the Wallsend Slipway and Engineering Co., where she will be fitted with triple-expansion engines.

Imperial Prince.—On June 18th there was launched from Messrs. Short Bros.' yard at Pallion, Sunderland, a steel screw steamer for the Prince Steam Shipping Co. She was named *Imperial Prince.* The dimensions of the steamer are:—Length, 293 ft.; breadth, 40 ft. She has been built of Siemens-Martin steel to the highest class in Lloyd's Register, and is to be fitted with triple-expansion engines of 200 H.P. by Messrs. George Clerke, Limited, Southwick.

Melbourne.—On June 18th Messrs. William Pickersgill & Sons launched at Southwick one of the largest steel cargo steamers yet built on the Wear. The dimensions of this vessel are:—Length, 367 ft.; breadth, 46 ft.; depth, moulded, 29 ft. This vessel has been built to the order of Mr. William Kish, of Sunderland. The engines and boilers are being supplied by Messrs. G. Clark, Limited, of Southwick, and are tri-compound surface-condensing, with cylinders 26 in., 42 in., 68 in., and 45 in. stroke. She was named *Melbourne.*

Lizzie.—On June 18th there was launched from the North Sands Shipyard of Messrs. Joseph L. Thompson & Sons, a steel steamer, built to the order of Mr. James Gray, J.P., of Whitby. The vessel is of the following dimensions, viz.:—Length, 284 ft.; breadth, 38 ft.; depth of hold, 19 ft. 5 in., having a deadweight capacity of 3,100 tons. The engines are of the triple-expansion type, having three cranks, the cylinders being 21 in., 35 in., and 57 in. respectively, with a stroke of 39 in. These are being built by Messrs. Blair & Co, Limited, of Stockton. The vessel was named the *Lizzie.*

Brenttor.—On June 18th there was launched from the yard of Messrs. John Blumer & Co., North Dock, Sunderland, the steel screw steamer *Brenttor*, built to the order of Messrs. J. Holman & Sons, London. The principal dimensions are:—Length between perpendiculars, 270 ft.; beam, 37 ft.; depth, moulded, 19 ft. 4 in. The engines are to be fitted by the North-Eastern Engineering Co., Limited, Sunderland.

Alfalfa.—On June 18th Messrs. Sir Raylton Dixon & Co., launched, from their No. 2 dockyard, a steel screw steamer which has been built to the order of Messrs. Arthur Holland & Co., London, making the sixth boat launched for this firm by Messrs. Dixon in three months. She is built on the web-frame principle, having poop, raised quarter-deck, long bridge, and topgallant forecastle, and is of the following dimensions:—

Length over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft.; with a deadweight capacity of about 3,300 tons. Her engines will be fitted by the North Eastern Marine Engineering Co., Limited, Sunderland, and are to have cylinders 21 in. 35 in., and 57 in., and 39 in. stroke. On leaving the ways the vessel was christened *Alfalfa*, by Miss Sewell, of Carlisle.

Screw Steamer.—On June 18th Messrs. Richardson, Duck & Co. launched from their yard at South Stockton a steel screw steamer of the following dimensions, viz.:—Length over all, 307 ft. 4 in.; breadth, extreme, 40 ft.; depth of hold, 20 ft. 2 in.; deadweight carrying, about 3,650 tons. The vessel has a half poop aft; accommodation for captain, officers, and passengers amidships; a raised quarter-deck; and a long bridge from after engine-room, bulkhead to stern. The engineers are berthed in a deck-house on quarter-deck, abaft engine casing, and the crew in forecastle. She is built to highest class at Lloyd's, and has a double bottom all fore and aft on the cellular principle, capable of containing about 560 tons water ballast. She is fitted with an Emerson Walker's patent steam windlass; 4 horizontal steam winches, &c.; engines by Messrs. Blair & Co, Limited, 22½ in., 37 in., and 61 in. by 42 in. stroke.

Tamarind.—On June 19th there was launched from the yard of Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, a steel screw steamer, built to the order of Captain Thv. Dannevig, R.N., of Christiania, Norway. The principal dimensions are:—Length, 237 ft.; beam, 33 ft.; depth, moulded, 18 ft.; with a deadweight carrying capacity of 1,800 tons. The vessel is constructed on the raised quarter-deck type, with cellular double bottom all fore and aft, and will take the highest class in Norwegian Veritas. The cabins are arranged in large house on bridge deck. Accommodation is provided for engineers and officers under after end of bridge, and for crew in topgallant forecastle. Steam and hand steering-gear is fitted on flying bridge, and screw gear in wheel-house aft. During construction the vessel has been superintended by Mr. Stianson, the surveyor for the owner. The engines have also been been built to the Norwegian Veritas requirements by the North-Eastern Marine Engineering Co., Limited, Wallsend, and are on the triple-expansion principle, having cylinders 17½ in., 28 in., and 47 in., with 33 in. stroke, capable of indicating 700 H.P., and of propelling the ship at a speed of 9½ knots loaded. As the vessel left the ways she was named the *Tamarind* by Madame Castberg, the wife of Captain Castberg, who is to take command. The berth vacated by the *Tamarind* will be immediately occupied by a duplicate vessel, also for Norwegian ownership.

Britannia.—On Jnne 19th Mr. Thomas Brown launched at the St. Lawrence Shipyard, Mushroom, a screw steamer, intended for deep-sea fishing. She will be engined by Messrs. Hedley & Boyd, North Shields, with compound engines; boiler built by Messrs. Eltringham, South Shields. The vessel was named the *Britannia*.

Pakeha.—On June 19th Messrs. Ropner & Son launched from their North Shore Shipyard, at Stockton, a steel screw steamer, of the following dimensions:—Length, over all, 378 ft. 6 in.; breadth, extreme, 47 ft.; depth, moulded, 29 ft. 9 in.; and she will carry 6,300 tons deadweight all told. She is built of Siemens-Martin steel, on the three-decked rule, and will class 100 A1 at Lloyd's. Her engines, by Messrs. Blair & Co., Limited, are of 2,100 I.H.P. The steamer has been built to the order of Mr. Chr. Fnrness, of West Hartlepool, and was named *Pakeha*.

LAUNCHES—Scotch.

Grimm.—On May 20th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun the steel screw steamer *Grimm*, for the Dampfschiff-Rhederei Hansa, Hamburg. Her dimensions are:—Length, 320 ft.; breadth, 40 ft.; depth, 26 ft. 6 in., with a gross tonnage of about 2,800 tons. Her machinery, which is on the triple-expansion principle, will be fitted by Messrs. John and James Thomson, Finnieston Engine Works.

Flying Eagle.—On May 20th a twin-screw tug steamer, built of steel, was launched from the yard of Messrs. W. B. Thompson & Co., Dundee. The tug, which was named the *Flying Eagle*, has been built for the Clyde Shipping Co., and is of the following dimensions:—Length, 145 ft.; breadth of beam, 24 ft.; and depth of hold, 12 ft. She will be fitted with triple-expansion engines, with cylinders of 12 in., 18 in., and 30 in. respectively, and a stroke of 30 in.; her boiler pressure being 150 lbs. per square inch.

Taviuni.—On May 20th Messrs. William Denny & Bros., Dumbarton, launched a steel screw steamer of about 1,500 tons gross register for the Union Steamship Co., of New Zealand, Limited, for the Fiji trade. Her dimensions are 250 ft. by 34 ft. by 19 ft. She was named the *Taviuni*.

Perth.—On May 21st the steamer *Perth*, built by Messrs. W. B. Thompson & Co., Dundee, for the Dundee, Perth, and London Shipping Co., was launched from the Caledon Shipbuilding Yard. The new steamer is 290 ft. 6 in. long, 36 ft. 6 in. beam, and 18 ft. 2½ in. deep. She is built throughout of mild steel to the highest class at Lloyd's. The engines are of the triple-expansion type, with cylinders 30 in., 47 in., and 75 in., with a piston stroke of 48 in., and were made at Messrs. Thompson's Lilybank Engine Works.

Ardnamurchan.—On May 22nd Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a fine steel three-masted sailing ship named *Ardnamurchan*, built to the order of Mr. Hugh Hogarth, of Glasgow and Ardrossan, net register tonnage 1,700 tons, deadweight carrying capacity on Lloyd's freeboard, 2,800 tons, and of the following dimensions:—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft. After the launch she was towed to the James Watt Dock, Greenock, to fit out.

Bosnian.—On May 23rd Messrs. Mackie and Thomson launched from their shipbuilding yard at Govan the *Bosnian*, a screw steamer of 348 tons gross, built to the order of Messrs. J. M'Farlane & Co., Glasgow, and intended for the Irish fish trade. Her dimensions are:—Length, 155 ft.; breadth, 33 ft. 6 in.; depth, 12 ft. She will be fitted by Messrs. Muir & Houston with triple-expansion engines of 450 I.H.P. She is fitted with Emerson, Walker & Co.'s windlass.

Strathallan.—On May 23rd Messrs. Russell & Co., shipbuilders, Greenock, launched a steel screw steamer of 2,340 tons gross for Messrs. Birrell & Sons, Glasgow. Her dimensions are:—Length, 294 ft.; breadth, 40 ft. 2 in.; depth moulded, 20 ft. 9 in. The new vessel, which is named the *Strathallan*, will be supplied with a set of triple-expansion engines by Messrs. James Howden & Co., engineers, Glasgow, with cylinders of 22½ in., 35½ in., and 58½ in., and a stroke of 39 in. She is fitted with Emerson, Walker & Co.'s patent windlass.

Kallatina.—On May 26th the steamer *Kallatina*, built to the order of the Clarence, Richmond, and Macleay Rivers Steam Navigation Co., Limited, of Sydney, New South Wales, was launched by her builders, Messrs. David J. Dunlop & Co., Inch Works, Port-Glasgow. This new addition to the company's fleet has been specially designed for passenger and cargo service over the bars of northern rivers in New South Wales, where she is intended to trade. The dimensions of the new steamer are:—Length between perpendiculars, 179 ft.; breadth, moulded, 28 ft.; depth of hold to main deck, 11 ft. 6 in. The machinery is of the three-cylinder type for a working pressure of 160 lbs., the boiler being specially large for burning native coal. The cylinders are 15 in., 23 in., and 38 in. diameter, by 27 in. stroke.

Dieppois.—On May 31st the Campbeltown Shipbuilding Co. launched from their yard at Campbeltown (Firth of Clyde) a handsomely-modelled screw steamer of 2,650 tons deadweight for M. Robert Delarne, Dieppe. Dimensions:—260 ft. between perpendicnlars by 36 ft. 9 in. by 19 ft. 6 in., moulded depth. Machinery, triple-expansion engines, 19 in., 31 in. and 51 in. by 39 in. stroke, to be supplied by Messrs. Muir & Houston, of Glasgow. This steamer has long raised quarter-deck, bridge-deck extending forward of foremast, topgallant forecastle, cellular double bottom, complete and speedy pumping facilities, Harfield's patent windlass, Alley & Maclellan's steam steering gear, workable from npper and lower bridges, Hastie's screw steering gear aft. All the latest improvements for navigating the ship economically and for the speedy loading and discharging of cargo are to be supplied, including four large steam winches, extending over either side of vessel, metaline bushed cargo and steering blocks, Weir's patent evaporator for a continuous supply of fresh water to boilers, exhaust tank in engine-room. Steam will be supplied by two large boilers having three corrugated furnaces in each. It is expected an average speed of 10 knots at sea loaded on a moderate consumption of fuel will be attained. The vessel has been built to the requirements of Lloyd's and Bureau Veritas for their respective highest class. Mr. Alexander Dewar, superintending engineer to Messrs. James Rankine & Son, shipowners, Glasgow, represented the owners. After a short religious service by the Rev. Archibald J. J. McDonnell (R.C.), the steamer was gracefully named the *Dieppois* by Miss Dora Baird, daughter of the Rev. Baird, 3, Granby Road, Edinburgh. After the launch the company adjourned to the builders' offices, where cake and wine was served. The Campbeltown Shipbuilding Co. have a 1,850-ton deadweight steamer of a similar type building on their own account, to be ready early in July.

Barque.—On June 4th the Grangemouth Dockyard Co. launched a steel barque from their yard at Kelliebank. The barque is built to the highest class at Lloyd's to the order of Mr. James Nourse, London, and has a tonnage of 1,400 tons. The principal dimensions are:—Length, 250 ft.; breadth, 37 ft. 6 in.; depth of hold, 21 ft.

Kelton.—On June 4th Messrs. Robert Duncan & Co., Port-Glasgow, launched a steel sailing ship of 1,930 tons gross register for Mr. T. C. Guthrie, Glasgow, named the *Kelton*. This is the seventh vessel Messrs. Robert Duncan & Co. have built for the Village Line, and she will be commanded by Captain Alex. Young, who has been for the past seven years in charge of the ship *Gretna*, built in 1883 for the same line by the Messrs. Duncan.

The Duke.—On June 4th there was launched from the shipbuilding yard of Messrs. John Fullerton & Co., Merksworth, Paisley, an iron screw steamer of about 400 tons gross, which they have built to the order of Messrs. J. & J. Hay, shipowners and shipping agents, Renfield Street, Glasgow, and is intended for their general carrying trade round the coast. This steamer, which is named *The Duke*, will have all the latest improvements for loading and discharging cargo, also steam steering gear and patent windlass.

Commodore.—On June 4th Messrs. Hawthorns launched from their yard at Leith a steel steam trawler named the *Commodore*, which has been built to the order of Mr. Thomas Devlin, Newhaven, for trawling for the local market. The vessel, which is 100 ft. long, 20 ft. broad, and 12 ft. deep, will be fitted by the builders with compound surface-condensing engines, having cylinders 17 in. and 34 in. by 22 in. stroke, working to boiler pressure of 90 lbs. From her fine model it is expected that she will attain a high rate of speed, and prove to be one of the best trawlers on the firth.

Bandersnatch.—On June 5th a new yacht, named the *Bandersnatch*, 2½ rated, designed by Mr. W. Fife, jun., Fairlie, and built by Mr. J. Ninlan, Largs, for Mr. D. B. Richardson, Glasgow, was successfully put into the water.

Frederica.—On June 5th Messrs. James & George Thomson, Limited, launched from their yard at Clydebank a handsome twin-screw steamer named *Frederica*, of 1,000 tons, to the order of the London and South-Western Railway Co. for their fast mail and passenger service between Southampton and the Channel Islands. The chief requirements of the trade are a high rate of speed with a comparatively light draught of water, and to attain this end the *Frederica* has been fitted with twin screws. She is built of steel throughout, and has been fitted with the builders' patent rudder with a view to giving her increased manœuvring powers in entering and leaving harbours and docks. The accommodation for first and second-class passengers will be exceptionally extensive and well appointed, and there will be a number of private state-rooms fitted within the after deckhouse on the quarter-deck, with lavatory attached, as well as a large first-class ladies' cabin. The ship is divided into eight watertight compartments, and the complement of boats and lifebelts will be in accordance with the new Life-Saving Appliances Act. She will also be lighted throughout with electricity by the builders, who have lately established an electrical department. The ventilation of the cabin spaces is carried out on a carefully-considered and complete system. The *Frederica* is expected to be ready for her trials early next month and will be closely followed by two sister ships.

Jessie.—On June 6th the Grangemouth Dockyard Co. launched from their shipbuilding yard at Grangemouth a handsomely-modelled steel screw-steamer named the *Jessie*, built to the order of the Jessie Steamship Co., Limited, Dundalk, Mr. William Twibill, manager. Dimensions as follows:—158 ft. over all by 24 ft. by 11½ depth, and is classed 100 A1 at Lloyd's under their special survey, having a raised quarter-deck bridge-house and topgallant forecastle, and is fitted up with all the latest improvements for working both ship and cargo, including Clark, Chapman's winches, Fisher's windlass, driven by messenger chain, and steam steering gear by Alley & M'Lellan, Glasgow. The vessel has been designed to carry a deadweight of 400 tons, and is the pioneer steamer owned in Dundalk, and will be employed principally in the general coasting trade. The engines are being fitted on board by Messrs. Hutson and Corbett, of Kelvinhaugh Engine Works, Glasgow, who are also the contractors in this case. The engines are of the usual compound surface condensing type, and are expected to drive the vessel at a good rate of speed.

Garthdee.—On June 7th a steel screw steamer, built to the order of the Aberdeen and Glasgow Steam Shipping Co., was launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen. The vessel is 200 ft. in length over all, 28 ft. 6 in. in breadth, 15 ft. in depth, and is registered to carry 700 tons gross. She will be fitted with triple-expansion engines of 100 N.H.P., and steel boilers with working pressure of 160 lbs. per square inch. The steamer was christened the *Garthdee*.

Orion.—On June 16th there was launched from Messrs. Ramage & Ferguson's shipyard at Leith a large steel sailing barque of 2,000 tons net register, built to the order of Mr. W. S. Crondace, Dundee. On leaving the ways the vessel was named the *Orion* by Mrs. Barker, wife of Captain Barker, who will take command of the vessel. Her principal dimensions are:—Length, between perpendiculars, 269 ft. by 41 ft. by 26 ft. 3 in., moulded. The *Orion* is a sister ship to the *Castor*, built at Leith for the same owner three years ago, and is intended for the jute trade.

Holt Hill.—On June 16th Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a four-masted sailing steel barque, named *Holt Hill*, of 2,350 tons register, to cary 3,750 tons deadweight. Length, 283 ft.; breadth, 43 ft.; depth 24 ft. 3 in. This vessel, which is to the order of Messrs. Wm. Price & Co., Liverpool, will complete her outfit in the James Watt Dock.

Mosquito, Avispa, Arana, Hormiga.—On June 17th Messrs. David & Wm. Henderson & Co. launched from their shipbuilding yard at Partick four steel sailing schooners, named respectively *Mosquito*, *Avispa*, *Arana*, and *Hormiga*. These vessels have been built to the order of Jas. & Alex. Allan, Glasgow, and are intended for their River Plate coasting trade. Their dimensions are:—108 ft. by 27 ft. 6 in. by 10 ft. 3 in., with a gross tonnage of about 220 tons. The *Mosquito* and *Avispa* were launched complete with masts and rigging, and proceeded up the harbour to receive a cargo of coal for the River Plate.

Strathavon.—On June 17th Messrs. Russell & Co., shipbuilders, Greenock, launched a steel screw-steamer of 2,500 tons register, and of the following dimensions:—Length, 300 ft.; breadth, 41 ft.; and depth, 22 ft. 2 in. She has been built to the order of Messrs. Burrell & Son, Glasgow, and on leaving the ways was named *Strathavon*. The new vessel, which is intended for the general trade, will be supplied with triple-expansion engines of 1,500 I.H.P. by Messrs. Blackwood & Gordon, Port-Glasgow.

Gertrude.—On June 17th Messrs. A. & J. Inglis launched from their yard at Pointhouse the *Gertrude*, a steel screw yacht of 137 tons gross, built to the order of Mr. Heys, Belfast. Her dimensions are:—Length, 126 ft.; breadth, 18 ft. 1 in.; depth, 11 ft. 5 in. She will be fitted by the builders with compound engines.

Voltaire.—On June 18th there was launched from Kellie Bank Shipyard, Alloa, a steamer 150 ft. by 24 ft. by 11 ft. 8 in., moulded, to the order of Messrs. Rogers & Bright, Liverpool, and engined by Messrs. Ross & Duncan, Govan. This vessel, named the *Voltaire*, is built for the West Coast coasting trade, and to the highest class in Lloyd's, with special survey.

Queen Margaret.—On June 18th Messrs. Alex. Stephen & Sons launched for Messrs. Thos. Dunlop & Sons, Glasgow, a handsomely-modelled steel screw steamer of about 4,300 tons deadweight carrying capacity, and which was named *Queen*

Margaret by Mrs. Alex. Raeside, Craiglea House, Dennistown. The *Queen Margaret* is built to the 100 A1 class three-deck rule in Lloyd's, under special survey, and is in every respect a splendidly-constructed and equipped cargo steamer. She has a double bottom on the cellular principle for water ballast, and having more than the requisite strength provided in the frame work without the use of hold beams, the holds have the great advantage of being unhampered for the reception of cargo of the bulkiest kind. The structures above deck embrace a poop, bridge deck amidships, having accommodation at after end for officers and engineers. Saloon, captain's room, and spare state-rooms are placed in an iron house on bridge deck, and are very compact and comfortably fitted-up. The crew are located in the topgallant forecastle forward. The engines, which were fitted on board before launching, are of the most improved triple-expansion type, having cylinders 23 in., 37 in., and 59 in. diameter, by 42 in. stroke, and will be supplied with steam at 160 lbs. pressure from two steel boilers. The vessel, which is the fourth built at Linthouse for Messrs. Dunlop, is fitted with all the most efficient appliances, including steam windlass, steam steering gear, steam winches, large donkey boiler, &c. She goes to Messrs. Gellatly, Hankey, Sewell & Co.'s berth this week to load for China and Japan, and will be commanded by Captain Robert Wilson, who has been for upwards of 15 years in the service of Messrs. Dunlop.

May Queen.—On June 18th Messrs. Marr Brothers launched from their yard at Old Church Street, Leith, a wooden steam trawler named the *May Queen*. The vessel, which has been built to the order of Messrs. M'Kay & Co., steamship owners, of 12, Junction Street, Leith, is 100 ft. in length between perpendiculars, 21 ft. in breadth, and 10 ft. 6 in. in depth. The engines will be supplied by Messrs. Hawthorns & Co., Leith. The launching of the vessel was marred by a rather awkward mishap. As she was clearing the ways she stuck and remained fast. Blocks and tackle were made fast, and in about half an hour the vessel was pulled into deep water.

Somedetch Phra Nang.—On June 18th the Fairfield Shipbuilding and Engineering Co., Limited, launched from their yard at Govan the *Somedetch Phra Nang*, a steel screw steamer of about 1,650 tons gross, built to the order of the Scottish Oriental Steamship Co., and intended for service on the China coast. Her dimensions are:—Length, 270 ft.; breadth, 36 ft. 9 in.; depth, 22 ft. 9 in. The engines are of the triple-expansion type, direct acting, with surface condenser. The cylinders are 22 in., 36 in., and 57 in. diameter, by 41 in. stroke.

Scindia.—On June 20 there was launched from the yard of Messrs. D. & W. Henderson & Co., Meadowside Works, Partick, a beautifully-modelled steel screw-steamer, named the *Scindia*, which is intended for the Eastern trade of Messrs. Henderson Brothers, and will form an important addition to their already large and well-equipped fleet. The dimensions are:—375 ft. long by 46 ft. broad by 30 ft. deep, with a gross tonnage of about 4,300 tons. Commodious rooms are fitted at the fore-end of bridge deck for a limited number of first-class passengers, care having been taken to ensure the thorough ventilation of the rooms for a warm climate. Engineers, petty officers, and firemen are berthed under the bridge deck, captain and officers in house on top of bridge deck, and seamen in topgallant forecastle. The vessel will be fitted by builders with a complete installation of electric light, including a search light for night passage through the Suez Canal. She will be rigged as a two-masted schooner, with square sails on foremast. The steam windlass is by Messrs. Harfield & Co., and Messrs. Napier Brothers are fitting their patent steam-steering gear. The vessel will be provided with all the latest and most approved appliances for the rapid loading and discharging of cargo. She will be fitted by builders with triple-expansion engines, having cylinders 26½ in. and 44 in., and 72 in. by 60 in. stroke.

Jose Romano.—On June 20th the Grangemouth Dockyard Co. launched a handsomely-modelled screw-steamer named the *Jose Romano*, of the following dimensions:—170 ft. by 25 by 11½, moulded. The vessel, which has been specially built for the Mexican passenger trade, has all the latest improvements for working the vessel with economy and dispatch. The engines, which are of the triple-expansion type, are being supplied by Messrs. Hutson & Corbett, Kelvinhaugh.

Templemore.—On June 22nd Messrs. Russell & Co. launched from their Kingston Yard at Port-Glasgow a three-masted steel sailing ship of 1,700 tons net register, built to the order of Messrs. Thomson, Dickie & Co., Glasgow. As the vessel left the ways she was named *Templemore* by Mrs. Drysdale, of Sea Bank, Gourock. The *Templemore* is a sister ship to the *Edenballymore*, launched in March by the same builders for the Maiden City Line. Her dimensions are:—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft.; and her carrying capacity is about 2,800 tons. She will be fitted out at Greenock and load at Glasgow. The *Templemore* will be commanded by Captain William Thomson, who has superintended her construction.

Garnock.—On June 23rd Messrs. S. M'Knight & Co., shipbuilders, Ayr, launched from their yard a steel screw steamer, built under special survey to class 100 A1 in Lloyd's registry, to the order of the Garnock Steamship Co., Limited, Messrs. Rowan & Bain, Ayr, managers. Dimensions:—Length b.p., 160 ft.; breadth, 25 ft.; depth of hold, 12 ft.; deadweight capacity, 560 tons. The engines are triple-expansion, and will be supplied by William Kemp, Govan; cylinder, 14 in., 22½ in., 36 in. by 27 in. stroke; speed, 10 knots, loaded. The vessel is named *Garnock*, being the first of a new fleet of steamers which the Garnock Co. are having built. Messrs. M'Knight have the second steamer well advanced, and expect to launch early next month.

Glenbreck.—On June 23rd Messrs. Robert Duncan & Co., Port-Glasgow, launched a four-masted steel sailing ship of 1,930 tons gross, to carry 3,100 tons cargo. Dimensions:—Length, 270 ft.; breadth, 40 ft.; depth, 23 ft. 8 in. This vessel is to the order of Mr. Robert R. Paterson, Greenock, and is sister ship to the *Oceana* and *Craigern*, built for the same owner by the Messrs. Duncan. The new vessel, which is named *Glenbreck*, was built under the superintendence of Mr. M'Ewan, Greenock. She will fit out at Port-Glasgow, and load at Glasgow.

LAUNCH—Irish.

Foyledale.—On June 21st Mr. Charles J. Bigger launched from the Foyle shipyard a very fine steel sailing ship of the following dimensions:—Length between perpendiculars, 255 ft. 6 in.; breadth, moulded, 39 ft. 5 in.; depth of hold, 23 ft. 2½ in. The christening ceremony was gracefully performed by Mrs. J. J. Joyce, Belfast Bank House, Londonderry, and as the vessel left the ways she was named the *Foyledale*. The *Foyledale* has been built to the order of Messrs. J. Henry Iredale & Co., and is the third ship of this size Mr. Bigger has built for them during the past eight months. Her registered tonnage is 1,700 tons, and she will carry 2,850 tons. As she is built on very fine lines, it is expected she will be very fast at sea, her sister ship, the *Lonsdale*, having just completed one of the fastest passages on record to Mexico. Immediately after the launch the *Foyledale* was towed alongside the sixty-ton crane, where she will receive her masts, and it is expected she will be ready for sea in about three weeks.

LAUNCH—German.

Lesbos.—On June 2nd a steel screw-steamer was launched by the Flensburg Shipbuilding Co. She is built for the Levante Line, in Hamburg, and has dimensions:—Length, 272 ft.; breadth, 36 ft. 2 in.; depth, 20 ft. 10 in. Triple-expansion engine 750 I.H.P. She is the first of three sister-ships which are being constructed on the Flensburg Shipyard for this company.

LAUNCH.—Swedish.

Ingenior.—The new steamer *Ingenior* has been completed by the Motala Engineering Co., Sweden. It is for the Cronstadt fortifications, and is built entirely of Motala mild steel. Its length is 110 ft.; breadth, 19½ ft.; draught, fully loaded, 6 ft It is especially intended for cruises of inspection along the Finnish coast. During the month two smaller steamers have been launched from the same yard, viz., a passenger steamer, *Falken*, with engines of 35 nominal H.P., for a Gothenburg company, and a cargo steamer, built for the "Göta Kanal" Co.

TRIAL TRIPS.

Chang-On.—The s.s. *Chang-On*—or *Long Tranquillity*—a new steamer built by Messrs. S. C. Farnham & Co., Shanghai, for the Shanghai Mutual Steam Navigation Co., went on her trial trip on May 1st, and was in every way a success. She is intended for the Hankow trade, and is expected to secure a large share of the river traffic, being designed to carry passengers as well as large quantities of cargo. She is a two-masted twin-screw three-decked steamer of the usual pattern. Her length is 212 ft. 8 in.; beam, 30 ft. 6 in.; depth of hold, 12 ft.; depth from promenade deck to keel, 27 ft. On the promenade or uppermost deck, which extends from end to end of the vessel, are the wheelhouse forward, officers' cabin, one cabin with bath-room for European passengers, and saloon. The saloon deck is principally devoted to Chinese passenger berths, of which there are 102 aft and 64 forward. She is fitted with two pairs of inverted direct-acting compound surface-condensing engines of 85 N.H.P. Two of the cylinders are 16 in. and the other two 32 in., with a 24-in. stroke. She has one cylindrical return tube boiler, 14 ft. 9 in. by 11 ft. 6 in., with three ribbed furnaces, and has Messrs. Napier Bros.', Glasgow, patent windlass. The boiler is built of mild steel, with a working pressure of 90 lbs. The hull is of mild steel, clinker built. Her registered tonnage is 1010·1. Gross tonnage, 1387·73 tons, with a lower hold capacity of 587·11 tons. On her trial trip she attained a speed of 12½ knots per hour, with a draught of 7 ft. 8 in. aft, and 4 ft. 6 in. forward; and on the return journey, against the tide, her speed was 11·4. Both vessel and engines were built by Messrs. S. C. Farnham & Co.

Shamrock.—On May 13th this screw tug, built by Messrs. E. Finch & Co., of Chepstow, to the order of Mr. D. B. McCallum, jun., of Cardiff, under the supervision of Mr. John McCallum, ran her trial trip from Chepstow to Lundy Island during a fresh breeze and a choppy sea. She is 90 ft. long; 17 ft. 6 in. broad, and 9 ft. 6 in. deep, with compound surface-condensing engines, having cylinders 18 in. and 34 in., by 24 in. stroke; one steel boiler working at 90 lbs. pressure. She is classed 100 A1 at Lloyd's, and is specially fitted for salvage operations, with patent steam windlass and winches; two 9 in. centrifugal pumps, by the Pulsometer Engineering Co., capable of discharging 1,700 gallons of water per minute, each together with a No. 11½ pulsometer, having a discharging capacity of 80,000 gallons per hour by itself. Everything passed off highly satisfactory to the owners, who were accompanied by a goodly party, the results being above the stipulations of the contract.

Marchioness of Bredalbane.—On May 21st the new Clyde river steamer *Marchioness of Bredalbane*, constructed for the Caledonia Steam Packet Co., Limited, went on her trial trip. The vessel, which was contracted for by Messrs. Rankin & Blackmore, engineers, Glasgow, has been built by Messrs. John Reid & Co., Port-Glasgow, and is 200 ft. long by 22 ft. beam and 7 ft. 9 in. moulded depth. The engine is of the diagonal compound surface-condensing type, having two cylinders 30 in. and 54 in. in diameter by 5 ft. stroke, working tandem on a single throw-crank shaft. Steam at 100 lbs. pressure is generated by two navy boilers, working in conjunction with forced draught on the closed stokehole principle. The steamer experienced very rough weather, but behaved splendidly, and attained a high rate of speed under most adverse circumstances. She is a 17-knot vessel.

Ragnvald Jarl.—On May 22nd the new steamer the *Ragnvald Jarl*, built to the order of the Nordenfjeldske Dampskibs Selskab, Throndjhem, by Messrs. Wigham Richardson & Co., of Walker, went for her trial trip off the Tyne. This vessel is one of the fine fleet of steamers which are to be employed for the mail and tourist service between the Tyne and Norway. The Norwegian government are establishing on an extensive scale a complete and direct oversea mail service, Newcastle having been selected as the port of departure from this country. The *Ragnvald Jarl* is 233 ft. long, by 30 ft. by 16 ft. 7½ in., and her engines, which are also built by Messrs. Wigham Richardson & Co., are of the triple-expansion type. On the occasion of her trial she ran up the coast as far as Coquet Island, and returned to Marsden for the purpose of consumption tests. The measured mile off Whitley was next traversed, when a speed of above 13 knots was obtained. The trials gave complete satisfaction to all concerned.

E. S. Lancaster.—On May 23rd the new steamer the *E. S. Lancaster*, recently built by Messrs. Thomas & William Smith, North Shields, to the order of Messrs. Lancaster, Speir & Co., Newport (Mon.) and Cardiff, had her trial trip at sea. Dimensions:—168 ft. 4 in. by 25 ft. 2 in. by 13 ft. 4 in.; engines, triple compound; cylinders 13¼ in., 22 in., and 36 in. by 24 in. stroke, by Messrs. J. P. Rennoldson & Sons, South Shields. The trial of ship and engines proved highly satisfactory both as to speed and sea-going qualities.

Trinidad.—On May 23rd the steel screw steamer *Trinidad*, recently launched from the yard of Messrs. John Blumer & Co., Sunderland, to the order of the Trinidad Steamship Co., London, proceeded to sea to run her trial. The ship, which is especially adapted for the iron ore trade, is of the following dimensions:—Length, 240 ft.; beam, 34 ft.; depth, 17 ft. 1 in. The builders of the engines are Messrs. Alley & Maclellan & Co., Glasgow, and throughout the trial they gave every satisfaction. The ship attained the mean speed of 11½ knots over the measured mile.

Aleppo.—The Cunard liner *Aleppo*, of the Mediterranean fleet, has had her engines converted to the tri-compound type by Messrs. James Howden & Co., Glasgow, and has been fitted with new boilers with Howden's patent system of forced draught. On Friday, May 23rd, she had a six hours' trial on the Clyde, the machinery working with smoothness and entire freedom from heating. The cylinders are 22½ in., 35½ in., and 58½ in. in diameter respectively, by 48 in. stroke. Steam is generated in two single-ended boilers, with four furnaces in all, the grate area being 62½ square ft. The power developed is reported at 1,350 I.H.P., or 21·6 I.H.P. per square foot of firegrate.

George Dumois.—On May 24th the new steel screw steamer *George Dumois*, recently launched by the Grangemouth Dockyard Co., from their shipbuilding yard at Alloa, went on her trial trip. On the measured mile a speed of 12 knots was attained, which is considerably in excess of the guaranteed speed. The engines were supplied by Messrs. Hutson & Corbett, of Glasgow, and are of the triple-expansion type. The *George Dumois* has been built to the order of Messrs. M. Kuhule & Son, ship-owners, Bergen, and has been specially designed and built for the fruit trade between the West Indies and New York.

Brazil.—On May 24th the steamer *Brazil*, built by Messrs. James & George Thomson, Clydebank, made her trial run down the Firth of Clyde, and attained the satisfactory speed of 13½ knots, after which she was handed over to the Brazilian Steam Navigation Co. of Rio de Janeiro, and will be captained by the able seaman, M. Duarte. The *Brazil*, which has three decks, is the builders' *beau ideal* of a steamer for a hot climate, the comfort of the passengers being studied in every particular. On the awning deck the voyagers can promenade from stem to stern, while there are deck-houses containing the music-room, the smoking-room, and the officers' quarters. The first-mentioned is luxuriously fitted up in mahogany, with amber wood mouldings, and sycamore panelling. The sofa seats in the music saloon are upholstered in moquette with a camel ground, and in the dining saloon the chairs and sofas are in an undyed grey haircloth covering. The state rooms have caned sofa seats also provided with portable cushions, and turn-up berths. The whole of the upholstery work reflects much credit on the upholsterers, Messrs. J. G. Rowan & Co., Greenock. Under the promenade deck there is accommodation for 106 cabin passengers, in spacious, well-appointed and ventilated state rooms. At the fore part of the ship there is comfortable accommodation for 400 emigrants or troops. The *Brazil* is 282 ft. long, 38 ft. broad, and 22 ft. deep, and she is fitted with triple-expansion engines. Her H.P. is 2,500, and her tonnage slightly over 2,000. The vessel throughout is lighted by electricity.

Constantinos Stathatos.—On May 24th the screw steamer *Constantinos Stathatos*, built by Messrs. John Readhead & Sons, West Dock, South Shields, to the order of Messrs. Stathatos Bros., of Ibrail, was taken to sea for her trial trip off the Tyne. The vessel is of the partial awning-deck type, and of the following dimensions, namely:—299 ft. between perpendiculars; breadth, 39½ ft.; depth, moulded, 26½ ft.; classed 100 A1 at Lloyd's, under special survey. She is fitted with shifting boards and bulkheads, to comply with the Grain Cargoes Act; and has triple-expansion engines, also built by Messrs. Readhead & Sons, with cylinders of 23 in., 37½ in., and 61½ in. in diameter, and a piston stroke of 39 in. The steam is supplied by two large steel boilers, at a working pressure of 160 lbs. to the square inch. The *Constantinos Stathatos* is the fifth steamer built for the same owners by Messrs. Readhead & Sons. The speed of the vessel was tested over the measured mile. The engines worked to the satisfaction of all concerned, and a speed of 12 knots an hour was attained.

British Queen.—On May 24th the large cargo steamer, the *British Queen*, recently launched from the yard of Messrs. Palmer & Co., Jarrow, went to sea on her trial trip. The dimensions of the vessel are as follows:—Length between perpendiculars, 400 ft.; breadth moulded, 47 ft.; depth moulded, 30 ft. 7½ in. She has been built under the special survey of Mr. Grundy, superintendent engineer to the owners, to class 100 A1 at Lloyd's, and is of the three deck type, with a poop, bridge, and topgallant forecastle. Upper and main decks of steel are fitted all fore-and-aft, the former being sheathed with pitch pine. Cellular double bottom for water ballast is fitted all fore-and-aft, and the vessel is also provided with a complete set of shifting boards, and grain hatches are arranged in 'tween decks for the carriage of grain. The 'tween deck is also provided for side-lights, and special provision has been made for ventilation, &c., suitable for the cattle trade. She has also a complete electric light installation. The vessel has a deadweight carrying capacity of 6,600 tons. The steamer made several runs over the measured mile off Whitley, and a mean speed of 13 knots an hour was obtained. This was two or three knots over the guaranteed rate of speed. The engines worked smoothly, and the trial gave every satisfaction. At the conclusion of the speed tests the vessel, under the command of Capt. Smith, proceeded to Dundee, where she will load for New York.

Ruskin.—On May 29th the s.s. *Ruskin*, a steel screw steamer, built by Messrs. Sir Raylton Dixon & Co., Middlesbro', to the order of Messrs. Arthur Holland & Co., London, proceeded from the Tees on her trial trip. This vessel is built on the raised quarter-deck principle, having a poop aft and a continuous bridge deck, forming a partial awning deck. Dimensions:—Length, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; deadweight capacity about 3,650 tons. Her engines have been fitted by Messrs. T. Richardson & Sons, Hartlepool, with cylinders 22 in., 35 in., 59 in. by 39 in. stroke, which proved perfectly satisfactory on trial. The *Ruskin* has been built under the supervision of Mr. W. Barclay, superintending engineer for her owners. This is the fifth steamer sent to sea by Messrs. Sir Raylton Dixon & Co. during the present month.

Duchess of Hamilton.—On May 29th the new paddle steamer *Duchess of Hamilton*, which has been built by Messrs. William Denny & Bros., Dumbarton, for the Caledonian Steam Packet Co., made a trial trip. The vessel, which ran her speed trials on the previous day, when she attained an average of 18·1 knots an hour, is intended to ply between Ardrossan and the Island of Arran in connection with the Lancashire and Ayrshire Railway. Her dimensions are 250 ft. between perpendiculars, by 30 ft. beam, with a depth of 10 ft. 6 in. moulded. She has a gross tonnage of 570 tons. The engines, which are by Messrs. Denny & Co., consist of a pair of compound-condensing diagonal steam engines.

Creole.—On May 30th the twin screw steam launch *Creole*, the principal dimensions of which are 43 ft. long by 10 ft. beam, built by Messrs. Forrestt & Son, at Wyvenhoe, for her Majesty's War-office, went on her official trial trip. The speed obtained was, we are informed, ten miles per hour; draught, with forty-five men on board, 17½ in. She has more than fulfilled her requirements.

Moss Rose.—On May 31st the steamer *Moss Rose* proceeded on her trial trip on the Forth. The *Moss Rose* is the latest addition to Messrs. Richard Hughes & Co.'s (Liverpool) fleet of coasting steamers, and has been built by the Grangemouth Dockyard Co. to the order of Messrs. Hutson & Corbett, who have supplied the machinery, which is compound surface-condensing, with cylinders, 20 in. and 40 in. by 30 in. The vessel is 150 ft. long by 23 ft. beam by 10 ft. deep, and on the trial trip attained a speed of 11½ knots between Inchkeith and the Oscar Light.

Ellen.—On May 31st the new screw tug *Ellen*, built by Messrs. R. and H. Green, of Blackwall, from the designs of Mr. T. Harrington, and engined by Messrs. John Stewart & Sons, Limited, was taken down the Thames on her trial trip. The *Ellen* has been specially constructed for Messrs. Phillipps & Graves, for the purposes of their lighterage business, this firm being largely engaged in what is known as the transhipment trade of the port of London. They are the London agents for several Continental and other lines of steamers, and have thus a considerable interest in securing despatch in all their dealings with goods for carriage over sea. Recent events in shipping circles, both at home and abroad, have caused much attention to be directed to this particular trade of the Thames, the successful conduct of which depends much upon the employment of adequate and suitable steam power. The latest addition to the fleet of Messrs. Phillipps & Graves is a valuable acquisition to the resources of the port in this respect. The *Ellen* is built with steel frames and iron plating, her deck being of fir. She is 75 ft. long, 14 ft. 6 in. broad, and 8 ft. 6 in. deep. She has been fitted with engines of the compound inverted direct-acting surface-condensing type, guaranteed to propel the vessel at a speed of 10·9 knots an hour. The diameter of the cylinders is 15 in. and 30 in. respectively, with a stroke of 18 in. The boilers are of steel, working up to 90 lbs. pressure, the engines being of 40 N.H.P. Two runs over the measured mile on Saturday showed a speed well in excess of that guaranteed, and the engines, which were running continuously for about six hours, worked throughout with the greatest smoothness. The tug is also specially fitted for extinguishing fire, so that any outbreak on board craft in tow, or in the vicinity, can be promptly dealt with. In the course of the day's proceedings reference was made to the improved prospects of shipbuilding on the Thames, consequent on the general advance of wages in the North, it being stated that tonnage and engines were now obtainable in London at prices which no longer rendered it necessary for owners to go elsewhere.

Adder.—On May 31st the paddle steamer *Adder*, built by the Fairfield Shipbuilding and Engineering Co., for Messrs. G. & J. Burns, for the Greenock and Belfast daylight service, went on her official speed trials. The stipulation was that she was to run six times consecutively between the Cloch and Cumbrae Lighthouses at an average speed of 19 knots. This the *Adder* not only did, but easily made 20½ knots, the average speed of the six runs being 19¾ knots. The *Adder* was afterwards placed upon the measured mile at Skelmorlie, on which she averaged 20¼ knots.

Strait Fisher.—On May 31st this fine steel screw steamer, built and engined by Messrs. McIlwaine & Maccoll, Limited, Belfast, to the order of Mr. James Fisher & Sons, Barrow, was taken down Belfast Lough on her trial trip. Her dimensions are:—Length, 174 ft.; breadth, 26 ft.; and depth, 14 ft. Her engines are of the triple-expansion type, having cylinders 17 in., 27 in., and 44 in. by 30-in. stroke. The boiler of steel, with three furnaces, is intended for a working pressure of 160 lbs. She is provided with ballast tanks, a pulsometer pump being fitted for pumping tanks and bilges, and a fine double cylinder donkey pump by Carruther, of Glasgow, is also supplied. One of Drysdale's centrifugal pumps is used for circulating condensing water. Three fine winches, made by her builders, are supplied, and the Sentinel steam steering gear by Alley and McLellan. On the whole, the vessel is fitted out in a very superior manner, and reflects credit on her builders. After a number of runs on the measured mile an average speed of 11·27 knots was obtained, which was considered very satisfactory. Among those present on the trial were Mr. McIlwaine, Mr. Maccoll, Mr. Fisher, Mr. W. Fair, B.T. engineer, surveyor, Mr. J. Maxton, Lloyd's surveyor.

Lieutenant Kasarsky.—The Torpedo cruiser *Lieutenant Kasarsky*, for the Russian Government, went on its trial trip at the end of May from the works of Mr. F. Schichau, in Elbing. The cruiser is 58 m. long, and 7·5 m. wide, with Schichau triple-expansion engines of 3,500 I.H.P., and two locomotive boilers of 12 atmos. working pressure. The ship had 95 tons of coal on board, besides the complete war outfit, and, we are informed, she easily fulfilled the contract condition, viz., to steam for three hours in succession at an average speed of 21 knots per hour. The torpedo boat *Anakreon*, the first of a new class of boats adopted by the Russian Government, 39 m. long, and 5 m. wide, also, we are informed, maintained a speed of 21 knots during a continuous trial of two hours' duration, with all outfit and coals on board. The torpedo Eclaireu boat *Adler* is a new type, similar to those of the Italian Admiralty named *Aquila* and *Nibbio*, was also tested. It is a twin-screw boat, 46·5 m. long, 5·2 m. wide, with two Schichau triple-expansion engines of altogether 2,200 I.H.P. The first trials took place on the measured mile during six runs, in order to ascertain the greatest speeds and the number of revolutions at such speeds, and we are informed that the average came to 27·4 knots on the six runs. On the two hours' run the average speed is said to have been 26·55 knots per hour, thus fulfilling the conditions of the contract. The Russian Government possesses in this torpedo Eclaireu one of the fastest, if not the fastest, existing steamers in the world.

Leon.—On June 3rd the s.s. *Leon* had her trial trip. This new steamer has just been completed by Messrs. Allsop & Sons, Limited, of Preston. She has been built to the order of Mr. A. Halvorsen, of Bergen, and is specially fitted up for carrying green fruit from the West Indies to New York, having a large number of ventilators from the upper deck to the lower hold and 'tween decks, and also tiers of steam-heating pipes round each hold space, and is sheathed with non-conducting material all round the cargo holds, so that the fruit may be thoroughly ventilated and yet preserved through great extremes of heat and cold at an even temperature. The *Leon* is a very handsome looking vessel, 205 ft. long, 28 ft. beam, and 19 ft. depth to the upper or awning deck. She has accommodation for passengers on the awning deck, and a deck-house for officers and engineers aft, also on the awning deck. She has triple-expansion engines of 120 N.H.P., with cylinders 11 in., 27 in., and 43 in. diameter and a stroke of 30 in. The vessel attained a maximum speed of 14 knots during her trial, and a mean speed of 13 knots over a distance of six miles, which was considerably above the speed guaranteed by the builders. This very satisfactory result may be partly attributed to the perfect working of the machinery which was remarked especially by a number of visitors on board, and partly to the fine and beautiful lines on which the hull has been designed. The steering gear is situated in a handsome teak house over the saloon, and in spite of a rather boisterous wind the *Leon* proved herself a very handy boat. The gear is Beck's patent combined steam and hand gear, and there is also a powerful screw-steering gear aft. The trip down the Ribble was very pleasant, and after the vessel was made fast to the buoys off Lytham, the party on board had luncheon and subsequently landed by the tender *Princess* and proceeded to Preston by rail.

Tetartos.—On June 3rd the s.s. *Tetartos* had a loaded trial in the bay, making a speed of 10¼ knots over the measured mile, everything working with the greatest smoothness and regularity. Mr. Schnack, the superintendent engineer for the Flensburg Co., was on board, and Mr. T. Mudd represented the engine builders. The *Tetartos* is a large and finely-modelled vessel, built in 1883 by the Flensburg Shipbuilding Co. for their own line, and carries about 3,500 tons deadweight. She was originally fitted with compound engines, which, though only seven years old, have now been taken out entirely at the Central Marine Engine Works, West Hartlepool, and replaced by a set of "Central" triple-expansion engines of 1,100 H.P. This case is an excellent proof of the advantage owners find in fitting the modern type of machinery, as the compound engines removed from this vessel were in first-class working order, but they required the consumption of 23 tons of coal per day, whilst the new triples now fitted will run on less than 14 tons. The vessel recently went on a light trial, making 12 knots at sea, and proceeded to Middlesbrough to load for China and Japan. The high price of coal and the reduction in freights are circumstances likely to bring a large influx of work of this class to our engine builders, as it is only by providing himself with the most economical engine known that the shipowner can hope to pay a steady, good dividend in the face of these adverse circumstances.

Tellus.—On June 4th the new steamer *Tellus*, 4,000 tons d.w., built by Messrs. Osbourne, Graham & Co., Hylton, Sunderland, to the order of Mr. W. Welhelmsen, Tonsberg, Norway, made a most successful trial trip, attaining an average speed of 11½ knots per hour. This is the longest steamer owned in Norway. She is fitted with triple-expansion engines of 1,200 I.H.P., by Mr. Geo. Clark, Southwick Engine Works, Sunderland; Morrison's evaporator and feed heater, and all the latest improvements, large donkey boiler, four steam winches, Pepper's patent steam steering gear, and Emerson and Walker's steam windlass. Both hull and engines during construction have been superintended by Messrs. George Noble and Buckle, consulting engineers, Newcastle.

Vasna.—On June 5th the steamship *Vasna*, built by the Ailsa Shipbuilding Co., Troon, for the coasting trade of the British India Company, went on her official trials. The steamer, on a run from Cumbrae Light to the Cloch and back, attained a mean speed of 11¼ knots, or 1¼ knot above the contract. The engines were supplied by Messrs. Dunsmuir and Jackson, Govan, and are of the triple-expansion type, having ordinary inverted cylinders of 17 in., 27 in., and 44 in. diameter by 30 in. stroke. Throughout the cruise the engines worked very smoothly and without a hitch.

Gleneden.—On June 5th the screw steamer *Gleneden*, a steel vessel which has been built for Messrs. Robert Livingstone & Co., of West Hartlepool, by Messrs. John Priestman & Co., of Sunderland, proceeded from the Wear on her first voyage and trial trip. She is built to Lloyd's quarter-deck rule, with accommodation for captain and officers under bridge amidships Her dimensions are:—Length, 240 ft.; breadth, 32 ft.; depth, moulded, 16·7 ft. Her engines have been supplied by Messrs. William Allen & Co., of the Scotia Engine Works, Sunderland, and have cylinders of 17 in., 28 in., and 46 in., with 33 in. stroke. They gave every satisfaction on the trial run, developing a speed of 9½ knots, fully loaded.

Wharfe.—On June 5th the new steamer *Wharfe*, of Goole, built by Messrs. William Dobson & Co., of Low Walker, to the order of the Goole Steam Shipping Co., Limited, for their service between Goole and the Continent, was taken to sea for trial of machinery and speed. The engines were run for six hours continually at full speed, with the result that a speed of 15¼ knots per hour was attained, the engines working satisfactorily throughout. The machinery of the *Wharfe* is by the Wallsend Slipway & Engineering Co., Limited.

Zampa.—On June 5th the large screw steamer *Zampa*, recently completed by Messrs. Edward Withy & Co., Middleton Shipyard, Hartlepool, proceeded on her trial trip in Hartlepool Bay. This vessel is a fine type of a modern cargo steamer, and has been built for the fleet of Messrs. Herskind & Woods, West Hartlepool. The steamer is over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. She has a long raised quarter-deck, short poop, long bridge-house and topgallant forecastle; the holds and 'tween decks are fitted throughout with iron grain divisions, and built on the web-frame system to give extra strength and enable the vessel to stow cargoes of the bulkiest description. She has large water ballast capacity fitted all fore and aft including after peak. To facilitate the discharging of cargo she is fitted with four large steam winches and a large donkey boiler. The anchors are of the stockless type hauling into hawse pipes with steam windlass, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin for the accommodation of the captain, passengers, and officers is handsomely finished in polished hardwood with painted panels executed in a very elegant and effective style by the decorative staff of ladies employed by the firm. The hull during construction has been built under the supervision of Captain Petersen. The triple-expansion engines with boilers have been supplied by Messrs. T. Richardson & Sons, Middleton Ironworks, Hartlepool, and have been built under the inspection of Mr. J. R. Fothergill, the engineering superintendent of the firm. Before leaving the harbour the vessel was gracefully christened *Zampa* by Mrs. Jabez Woods, wife of one of the managing partners. After taking her passengers on board the vessel proceeded in a northerly direction and a mean speed of over 11¼ knots was attained, the ship being in light condition, the engines and all working parts giving the greatest satisfaction to the owners' representatives. On the completion of the trial trip the vessel proceeded to Cardiff to load for India.

Arundo.—On June 6th the official trial trip of the s.s. *Arundo*, built by Messrs. C. S. Swan & Hunter, Wallsend, took place on the measured mile off Whitley, and the result proved highly satisfactory to the owners and builders, the average speed attained being 11¾ knots per hour. The vessel, which is owned by Messrs. Hudig & Veder, Rotterdam, is of the following dimensions:—Length, 275 ft. over all; beam, 37 ft.; depth, moulded, 19 ft. 9 in., and built on Messrs. C. S. Swan & Hunter's improved well-deck type, viz., with full poop, long raised quarter-deck, long bridge-house amidships, break deck forward and full topgallant forecastle and has cellular double bottom all fore and aft, and all fittings of the latest improved description. The engines have cylinders 20 in., 33 in., 54 in., and 39 in. stroke, and are by Messrs. Alley & McLellan, Glasgow. Mr. Veder, of Rotterdam, with Captain Posthumus, and Messrs. T. W. Pinkney, McFarlane, of Sunderland, and others, attended the trial trip.

Marchioness of Bute.—On June 6th the new steamer, *Marchioness of Bute*, contracted for by Messrs. Rankin & Blackmore, engineers, Greenock, for the Caledonian Steam Packet Co., Limited, went on her trial trip. The hull was built by Messrs. John Reid & Co., Port-Glasgow, and the diagonal compound surface-condensing engines supplied by the contractors, Messrs. Rankin & Blackmore. Her dimensions are—Length, 200 ft.; breadth, 22 ft.; depth, 7 ft. 9 in. The steamer ran the measured mile in the Gareloch, and attained a mean speed of 17 knots, which is half a knot over the guaranteed speed, for which the contractors receive a premium.

Kong Ince.—On June 7th the screw steamer *Kong Ince* left the Tyne on a trial trip. This vessel, built by Messrs. Wood, Skinner & Co., Bill Quay, for the Sondenfjeld Norske Pampskebsilskal, Christiania, is of the following dimensions:—Length, 178 ft.; breadth, 27 ft.; depth, 13 ft. 3 in. She is specially built for the passenger trade between Christiania and Hamburg. The engines are of about 550 H.P., and have been built by the North-Eastern Marine Engineering Co., Wallsend, and during the trial the machinery worked well, and gave every satisfaction, the ship attaining a speed of 11 knots.

Ohm.—Mr. John Read, jun., shipbuilder, Portsmouth, has a contract under the War Department for building four twin-screw submarine mining steam launches, 48 ft. long between perpendiculars, and 10 ft. 9 in. beam, whilst Messrs. Vosper & Co., engineers, Portsmouth, are entrusted with the engining of the boats. On the 9th June, the second of these launches, the *Ohm*, ran on her official steam trial of four hours' continuous steaming at Portsmouth, with the War Office and dockyard officials on board. She attained a speed of 9·16 knots with 85 I.H.P., whereas the speed contracted for was only 9 knots and 70 I.H.P. Each boat is fitted with two capstans, which are worked by Vosper & Co.'s four-cylinder engines.

Bendo.—On June 9th the screw steamer *Bendo*, built by Messrs. Schlesinger, Davis & Co., of Wallsend, for Mr. Jos. Hoult, of Liverpool, was tried at sea off the Tyne and gave very satisfactory results. The steamer is of the following dimensions:—Length between perpendiculars, 345 ft.; breadth, moulded, 42 ft. 11 in.; depth, moulded, 24 ft. 1 in.; and will carry over 5,100 tons when fully laden. She is provided with every necessary appliance for easy working and manoeuvring, and for the speedy and economical loading and discharging of cargo. The propelling machinery supplied by the North-Eastern Marine Engineering Co., of Wallsend, is of the triple-expansion type with cylinders 25 in., 45 in., and 64 in. diameter and 45 in. length of stroke. Everything worked with perfect smoothness and a speed of 10½ knots per hour was attained. Amongst the company present during the trial were Mr. Jos. Hoult, the principal owner, and Mr. A. C. Hay, superintendent for the Ben line of steamers, Mr. Dodds and Mr. Wait, jun., of the firm of Messrs. James Wait & Son, Mr. Kelvington and Mr. Philipson, representing the North-Eastern Marine Engineering Co., Mr. Davis, Mr. T. Allan Johnson, manager to Messrs. Schlesinger, Davis & Co., Mr. John Jamieson, consulting engineer, of Newcastle, &c. The *Bendo*, which is the fourth vessel built for the same owners by the Wallsend firm, is about to load for Genoa.

Elisa Cerana.—On June 10th this vessel, which has been built by Messrs. W. Harkess & Son, of Middlesbro', and engined by Alexander Shanks & Son, of Arbroath, proceeded to the Forth to run her trial trip. During the trial her engines worked without a hitch, and an average speed of 15 miles an hour was attained, which was considered highly satisfactory. After the trial the vessel proceeded to Boness to take bunker coal, after which she will proceed to take up her station on the river Panama.

Tai-Yiok.—On June 10th this steamer, built and engined by the Flensburger Shipbuilding Co., in Flensburg, to the order of Mr. H. C. Edward Meyer & Co., of Hamburgh, was taken on her trial trip in the Flensburg Bay. Her dimensions are:—Length, 250 ft.; breadth, 32 ft. 2 in.; depth, 22 ft. 6 in.; gross tonnage 1,430. She has been fitted with triple-expansion engines 650 H.P. During the run on the measured space of ten miles, an average speed of 11·25 knots was attained by a consumption of coal of 1·40 lbs. The party was landed in Glücksburg. The owners expressed the greatest satisfaction with this steamer which is intended—like their two other steamers *Tai-Lee* and *Tai-Cheong*—to trade on the Chinese coasts.

Hirondelle.—On June 11th the trial trip of the steamer *Hirondelle*, recently launched by Messrs. Gourlay Brothers & Co., at Dundee, took place on the Tay, but unfortunately the weather was very unpropitious. The *Hirondelle* has been built to the order of the General Steam Navigation Co., of London, and is intended to trade between London and Bordeaux. Her dimensions are:—Length, between perpendiculars, 268 ft.; breadth, 37½ ft.; depth, moulded, 19 ft.; her gross tonnage being about 1,600. She is fitted with triple-expansion engines of 400 N.H.P., and has steam cranes, steam steering gear, and all the latest improvements. Accommodation is provided for 80 first-class and 40 second-class passengers. Under easy steam, on a distance of about 18 knots, the vessel attained an average speed of 15 knots an hour, which is largely in excess of the speed contracted for. The steamer left shortly afterwards for London.

Tandil.—On June 12th the s.s. *Tandil* proceeded from the Tees on her trial trip. This vessel has been built for Messrs. Arthur Holland & Co., London, by Messrs. Sir Raylton Dixon & Co., Middlesborough, and is the third vessel they have sent to sea for this firm. She is built on the web frame principle, having a poop, raised quarter-deck, bridge, and t g. forecastle, her leading dimensions being—Length over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a deadweight capacity of about 3,300 tons. Her engines have been fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland, and on trial gave every satisfaction, developing a speed of 11 knots. The vessel has been built under the supervision of Mr Barclay for her owners.

Sama.—On June 13th the new steel awning-decked screw steamer *Sama* went on her official trip before being handed over to her owner, Mr. Jacob Christensen, of Bergen. She was built by the Abercorn Shipbuilding Co., and engined by Messrs. Hannah, Donald & Wilson, Paisley. Her dimensions are 185 ft. by 28 ft. by 19 ft. 10 in. moulded, with the latest type of triplex engines of 85 N.H.P.; cylinders, 15½ in., 25 in. and 40 in. by 33 in. stroke. Working pressure of boiler, 160 lbs.; class, 100 A1 at Lloyd's. She is intended for the carrying of fruit between Cuba and New York, for which trade she is specially fitted up, and has accommodation for 16 first-class passengers, every attention being paid to the ventilation of holds, passenger accommodation, and crew spaces. Her average speed on the measured mile was about 11½ knots, with 400 tons deadweight aboard. There was a large company on board, including the owner's representative, who all expressed themselves highly satisfied with the vessel's performance.

Talbot.—On June 13th the new screw steamer *Talbot*, lately launched by Messrs. S. M'Knight & Co., Ayr, for Mr. J. Bacon. Limited, Liverpool, for their general carrying trade between Liverpool, Swansea, and Port Talbot, proceeded on her official trial on the Forth of Clyde. The average speed she attained on the measured mile at Skelmorlie was 12 knots an hour, which was considered most satisfactory. The *Talbot's* dimensions are:—Length, 180 ft. by 27½ ft., by 13½ ft.; 550 tons gross measurement. The machinery, which has been supplied by Muir & Houston, Glasgow, is triple-expansion, and the main boiler, which is of steel, is adapted for 160 lbs. working pressure.

Clutha, No. 7.—On June 14th this new Glasgow harbour passenger boat went on a trial trip up the Gareloch. The boat gave great satisfaction, and on the measured mile went about a knot more than the contracted speed.

Inverness.—On June 16th the screw steamer *Inverness*, a new vessel, 272 ft. 3 in., by 38 ft. 10 in., by 20 ft. 10 in., built by Messrs. Ropner & Sons, of Stockton, for Messrs. Sanderson & Co., of Hull, left the Tees for her trial trip. Her engines are on the triple-expansion principle, of 160 H.P. nominal, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, working at 160 lbs. pressure of steam, and built by Messrs. Blair & Co. Limited, of Stockton-on-Tees. She made a successful run, attaining a speed of about 11 knots.

Talune.—On June 18th the screw steamer *Talune*, recently launched by Messrs. Ramage & Fergusson, Leith, for the Tasmania Steam Navigation Co., went down the Firth of Forth on her trial trip. The *Talune*, which is schooner rigged, and is over 2,000 tons gross register, is 280 ft. long, 28 ft. beam, and 24 ft. deep. She has triple-expansion engines, with cylinders 23 in. and 61 in. by 45 in. stroke. The trial was considered in every way satisfactory.

Kallatina.—On June 18th and 19th the s.s. *Kallatina*, which was launched on May 26th by Messrs David J. Dunlop & Co., from Inch Works, Port-Glasgow, made her official trials with the most satisfactory results. This steamer has been built to the order of the Clarence, Richmond & Macleay Rivers Steam Navigation Co., Limited, of Sydney, New South Wales, and fully described in the account of the launch, and we can only add that in the completion of the vessel no pains have been spared by the builders to give a first-class finish to all the departments, the first-class saloons and state rooms being specially handsome besides being thoroughly well lighted and ventilated, while the second-class accommodation is finished with every regard to the comfort of passengers. The *Kallatina* is specially constructed for a light draft service, and under contract had to carry 200 tons of deadweight on a draft of 7½ ft. of water. Under the stipulated conditions the steamer was to steam 11 knots per hour. After a series of progressive runs had been made, the steamer was put upon her full speed trials, when a mean speed of 11¾ knots per hour was obtained. The engines, of which the cylinders are 15 in., 23 in., and 38 in. diameter and 27 in. stroke, worked on both days with perfect smoothness and steadiness, and, from the large boiler power at command, the full pressure of steam was maintained at all times without effort. After the trials the *Kallatina* commenced loading the balance of her cargo in the James Watt Dock, and she is expected to sail on the 26th inst. direct for New South Wales, under the command of Captain Henry Creer, who has been Inspector of the vessel during her construction.

Aloedene.—On June 19th the steamer *Aloedene*, which was lately launched from the shipbuilding yard of Messrs. Short, Brothers, and built to the order of Messrs. J. T. Lunn & Co., of Newcastle-on-Tyne, went out on trial trip, and, after adjusting compasses, was taken to the measured mile off Whitby. After a series of runs a mean speed of about 11 knots was obtained, the engines working with perfect smoothness, and the trial being in every way satisfactory. The vessel is built of steel and to the highest class in Lloyd's Registry. Her engines, which are 200 N.H.P., are by Messrs. George Clark, Limited, Sunderland.

Prodano.—On June 19th the clipper stem spar-decked screw steamer *Prodano*, built at Blyth, by the Blyth Shipbuilding Co., Limited, for the Pinkney & Son's Steamship Co., Limited, of Sunderland, had a highly satisfactory trial trip. The vessel, which is 330 ft. in length, left the builders' yard early in the morning under the command of Captain Trotter, and before midday a large party of ladies and gentlemen were taken by tug from the south docks at Sunderland and joined the *Prodano*. A trial of speed was then made, and an average of 11¼ knots was steadily maintained. The party sat down to an excellent luncheon, which was served in the 'tween decks, and the usual toasts were honoured: The builders of the ship and the makers of the engines, the North Eastern Engineering Co., Limited, of Sunderland, were complimented on the excellent character of the whole of the work, all of which has been carried out under the superintendence of Messrs. Tom Colling and John Brock as representatives of the owners. The *Prodano* sailed for Hamburg with the good wishes of all for her success.

Duchenfield.—On June 20th the s.s. *Duchenfield*, recently launched by Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, went down the Clyde for speed trial, and on the measured mile attained a mean speed of 11¼ knots. The *Duchenfield* is a steel twin-screw steamer, 220 ft. by 31 ft. by 15 ft. 6 in., and is fitted with overlapping propellers. The engines, which are Messrs. Fleming & Ferguson's patent quadruple to 1,200 I.H.P., with 200 lbs. pressure, worked splendidly, and gave great satisfaction to the different engineers on board. This vessel has been built to the order of Messrs. F. & A. Brown, of Sydney, for their Colonial trade.

Dolores.—On June 20th the s.s. *Dolores*, a steel screw steamer, built by Sir Raylton Dixon & Co., Middlesbro', for Messrs. Arthur Holland & Co., London, took her trial trip from the Tees on Friday. This is the fourth of the vessels on order delivered to her above-named owners this year. She is built on the web-frame principle, having poop, raised quarter-deck, and topgallant forecastle, her chief dimensions being:—Length over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; deadweight capacity about 3,300 tons. Her engines have been fitted by Messrs. The North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke.

Flowerdale.—On the 20th June the official trial trip took place of Mr. David Macbrayne's handsome twin-screw steamer *Flowerdale*, intended for the West Highland trade between Strome Ferry, Portree, Sternoway, &c., for which her passenger accommodation has been specially adapted. She has large saloon aft on main deck, lofty, well lighted, and ventilated, and is otherwise equipped throughout as a passenger steamer to meet all the recent Board of Trade requirements, one of their officers being present at the trial. The result of several runs over the measured distance, in spite of a strong breeze, showed a mean speed of nearly 14 miles per hour, being considerably in excess of what was anticipated. She was expressly fitted with Wrench's patent propellers, which added 1¼ knots to the speed obtained with ordinary propellers at a recent trial.

Norna.—On June 21st the trial trip of the s.s. *Norna* took place in Hartlepool Bay. She has been constructed by Messrs. Edward Withy & Co., Hartlepool, for Messrs. Herskind & Woods, of West Hartlepool. Her engines, which are of the triple-expansion type of 200 N.H.P., having cylinders 21½ in., 35 in., and 58 in. by 39 in. stroke, 150 lbs. working pressure, were built at the Central Engine Works, West Hartlepool, and worked very smoothly, giving every satisfaction to the owners and all concerned. During two hours' consecutive steaming a mean speed of 11 knots was obtained.

Malvern.—On June 21st this large steamer, which was built by Messrs. Wm. Gray & Co., and is a sister vessel to the *Harrow* and *Eton* previously launched for the same owners, Messrs. Galbraith, Pembroke & Co., Limited, London, went on her trial trip. The vessel is 310 ft. long; breadth, 38 ft. 6 in.; depth, 23 ft. 3 in.; and she carries over 3,800 tons deadweight. The engines are of the triple-expansion type manufactured at the Central Engine Works, and are of 1,100 I.H.P., the boiler pressure being 160 lbs. per square inch. After adjusting compasses she took on board Mr. Pembroke, the senior managing owner, Mr. Pembroke, jun., and Mr. Curry. Captain Page, the marine superintendent, and Mr. T. O. Charte, superintending engineer to the firm, were also on board, and the whole of the above named gentlemen proceeded with the ship to South Wales. Mr. Jones and Mr. Mudd were also on board representing the shipbuilders and the engineers. She made an excellent run off Hartlepool for a few hours, the engines running 85 revolutions a minute without hitch of any sort, the bearings keeping perfectly cool, and everything in the engine-room satisfactory. She then proceeded on her way to Barry Dock, landing some of the passengers at Whitby, which port she passed two hours after leaving Hartlepool.

Sinope.—The official trials of the imperial Russian ironclad *Sinope* have been completed at Sebastopol, and the results are considered highly satisfactory. This warship, one of the most powerful in the Russian navy, has been built at Sebastopol, and forms one of the Black Sea fleet. Her dimensions are:—Length, 339 ft.; breadth, 69 ft.; displacement, 10,150 tons. She is built of steel, with a complete belt of compound armour from 12 in. to 16 in. thick, and a steel protective deck 3 in. thick. The machinery consists of two sets of twin-screw triple-expansion engines, with 14 single-ended boilers, and has been constructed at Glasgow by Messrs. R. Napier & Sons, who have also fitted the engines on board at Sebastopol. The speed on trial was 17·35 knots, with 12,750 H.P., without forced draught, being 150 I.H.P. in excess of the contract, and the consumption 1·35 lb. per I.H.P. per hour, which is considerably less than was stipulated.

Philadelphia.—This new American cruiser has had a trial. A speed of 20¾ knots was maintained for 3½ hours, with a steam pressure of 154 lbs., at 118 revolutions per minute. The contract speed is 19 knots, a premium of 50,000 dols. being paid for each quarter knot over 19, H.P. not being considered. The vessel is 335 ft. in length, 43 ft. 6 in. broad, with a mean draught of 19 ft. 3 in. The engines are of horizontal triple-expansion type, to develop 10,500 H.P.

Asphodel.—The new screw steamer *Asphodel*, built and engined by Messrs. Alex. Stephen & Sons, Linthouse, for Mr. J. B. Murray, Glasgow, has had successful speed trials on the Clyde. The vessel in question is 310 ft. long, 41 ft. broad, and 26 ft. 3 in. deep. The engines are of the tri-compound type, with cylinders 23 in., 37 in., and 59 in. in diameter respectively, the stroke being 42 in., while the boiler pressure is 160 lbs. to the square inch. On the measured mile the speed was 10·683 knots.

A new torpedo vessel.—An experimental trial has been made in Stokes Bay, Portsmouth, of a new torpedo vessel, built by Mr. J. Samuel White, East Cowes, on his turn-about system, and engined by Messrs. Belliss & Co., Birmingham. The vessel is a further development of the *Swift* type of torpedo-catcher supplied to the Admiralty by the same builder about two years ago, and now known as No. 81. It is, however, longer by 50 ft., with proportionately greater beam and superior accommodation; and whereas the *Swift* was only capable of stowing 45 tons of coal in the bunkers, the present boat can stow as much as 100 tons. Substantially, it may be said to resemble the *Rattlesnake*, but possesses shallower draught. The trial consisted of an hour's run at natural draught, when a speed of 18·64 knots was obtained. This was followed by a full-power trial of another hour's duration, the result being a mean speed of 21·46 knots. Circles were turned to port and starboard in 1¾ minute, the diameter of the circles being about two lengths of the vessel. The weights carried were 50 tons of coal and 40 tons of ballast to represent armament, stores, and equipment, making a total of 90 tons. There was remarkably little vibration either at cruising or full speed, and no perceptible inclination on the rudders being put hard over. The dimensions of the vessel are:—Length, 209 ft.; breadth, 23 ft.; extreme draught of water when fully loaded and equipped, 8 ft. 4 in. The hull is divided into numerous watertight compartments, and the machinery is well protected by coal bunkers, which extend at the sides throughout the whole length of the engine and boiler rooms, and are constructed watertight to the skin of the vessel. The maximum coal capacity of the bunkers is 110 tons, which is more than the usual capacity in craft of the size and I.H.P. This would enable the vessel to accompany ironclads on long voyages and to act as a scout, for which duty her exceptional speed would prove a valuable factor, while her comparatively shallow draught would allow of her following torpedo-boats into shoal water.

Reviews.

Engineering Popularly and Socially Considered. By J. W. C. Haldane. London; E. & F. N. Spon. 1890.

THIS is a work which as its name implies does not go into the technical details inseparable from volumes which aim to be a guide to those who conduct the various engineering operations. It is a new feature to us to tell in a chatty way what steam navigation was in the early periods, and to carry the reader through the different phases of ship construction and launching, finishing up with quadruple-expansion engines. An error with many works of the present day is certainly that they are too scientific, or otherwise abstruse. In many cases from the nature of the subject this is necessarily so. Too often, however, there is no reason for the general difficulty experienced in getting at the author's ideas. Here we are at the other extreme, and find positive light reading. This being a second edition, it may be concluded that there is a numerous class both professional and non-professional, those who are responsible for completing orders, as well as those who are in the outer circle only, to whom a work of this character is of considerable interest. We are told that the general public know all about doctors and solicitors, but that the inner life of the engineer is a sealed book to them. There is a great deal of truth in this, though we think the truism may be carried further, and it may be said that there is still more want of knowledge displayed respecting the various branches of the profession. The first chapter not only gives the early history of steamers, but also of canals and railways. We are told in connection with this last that a good beginning has taken place in China, but we are afraid this is somewhat premature. Bearing out the nature of the light reading provided the author becomes too light occasionally, and mentions an old story about the Japanese handling a steamer in the early days, to them, and losing their heads, so that they had to let the steam become exhausted before the ship could be stopped. Though perfectly true, this is put forward as if it were a matter of recent occurrence.

Incidents in the lives of well-known engineers are sure of a good reception, and these appear to have been well selected. We find mention of the different types of engine that were the pets of the various firms in past times, and then are led to the survival of the fittest, which are in vogue to-day. Strikes and their evils come in for a share of attention. The author misses nothing that has to do with the matter. As an instance of the style adopted, a hurricane that blew at Dumbarton in 1856 serves to introduce a discourse on wind pressure generally and the necessity of a civil engineer having the effects at his fingers ends. A chapter is devoted to apprentices and some of the causes leading to failure on the part of aspirants to attain much success. This should be of value. We also are told what occurs in the office when an enquiry comes in for a large job, how the partners and the head draughtsman talk the matter over and finally decide on their proposals. The mode of procedure in getting out the necessary calculations are next described, and in this connection there are some useful rules found, as also the names of books usually in favour with the staff. Work in progress shows the raw material coming to hand in the first instance and leaving ready to put in place. The position of superintending engineers is then touched upon, and the duties allotted to them. It appears to be thought that these responsible individuals are out of place in criticising the details of a design. This we opine depends on circumstances. The interiors of engine shops and boiler yards are gone into fully, mostly by means of a supposed conversation between the engineer and the foreman controlling the erection. The plan is one which has much to recommend it, for a side light is thus let in upon many points that would in the ordinary way be passed over entirely. Several pages relate in an amusing way to the choice of names for a ship, and how the principal lines settle the matter by taking in the one case, countries, another cities, and so on, to designate their vessels. The ceremony of launching receives that due share of attention its importance demands. We have most minute details, from the lady who christens the ship down to the newspaper reports next day. It might be thought there was a likelihood of repetition, and in the wrong hands this would occur. The author, however, steers clear of this fault, and tells his story in a racy fashion. We have trial trips, the vagaries of Atlantic captains, passengers joining a ship for the first time, all made to fit in a single chapter. Then to succeed, the inevitable breakdowns and losses are not allowed to pass without notice. The experiences and obstacles in the path of an engineer first starting on his own account serve to fill a chapter in an interesting way, and should be useful to those embarking in business for themselves. Engineers will find the last portion of the book of service, viz., that which illustrates and gives particulars of the most recent peculiarities of design in marine engines and details. We must, however, refer readers to the volume itself for further information. The historical, the conversational, and practical are fairly well blended together. Our Clyde and Liverpool friends will find many allusions to well known characters turning up in its pages which are likely to produce a hearty laugh.

Boilers—Marine and Land. By J. W. Traill, R.N. London: Chas. Griffin & Co. 1890.

THIS is the second edition of the present work. No greater proof is therefore wanted as to the usefulness of the handbook the author presents for public support, as only a year has elapsed since the first issue. In this handbook of rules, tables, &c., guiding those who have to do with the construction and working of boilers, a great deal of useful information is to be found. The properties of the material are first dealt with, then the details of boilers in general, after which the reader is taken to the various formulæ and tables required in construction, till finally he arrives at those concerning water, both pure and sea, safety valves, the properties of steam, and such items as Whitworth screws. The author does not aim so much, except in a general way, at assisting manufacturers as he does to help those who have to settle the safe working pressures to be adopted in boilers already built. This is a very numerous class, and well worth catering for. We do not find, therefore, the way in which material is to be cut up for use in the shop, as we do series of tables running through some 500 pages and embracing all that relates to the subject. In short, the book is more an inspector's *vade mecum* than a maker's. Still, the latter will find in a neat form much that will help him, especially as the figures are claimed to be quite original. It will be understood, therefore, that 70,000 results being furnished, the work is designed to save the labour of calculation. Two, and sometimes three, independent computers have been employed, so there can be no question on the score of accuracy. One asks only where to pick out what is wanted from the vast mass at a moment's notice. From the necessary length of some of the tables, the index, while being all that is required, is not of undue dimensions. A reader turns here, therefore, to find what he may want.

There are 350 different tables alone. Each of these has a descriptive introduction and an example to begin with. Where necessary, duplication is found to embrace steel construction as well as iron, and in the case of furnaces there are additions for the various corrugated and special forms. The matter is fairly elaborate also. Minute directions are given as to the treatment of steel, water gauges, test cocks, and other details. An inspector that can master all that is contained in this medium between a pocket book and large-sized volume will deserve well of those who employ him. The author has done the best possible to enlighten a person brought face to face with problems relating to boilers. If any difficulties are experienced, they would rather be due to limitations of space preventing there being more descriptive matter. In short, considerable scientific training would be necessary in order to utilize the results to the fullest extent. However, if the Chief Engineer to the Board of Trade is not aware what an inspector wants ready to his hand, there is no one to tell him. It may be taken, therefore, that the work is as near perfection as the long experience of superintending the boilers that come under Government inspection can make it.

Electric Engineering for Electric Light Artisans and Students. By W. Sligo and A. Brooker. London: Longmans, Green & Co. 1890.

This is a large work introduced principally for those going through a course of study at a collegiate institution, but may be also of value to anyone with little previous knowledge of electricity, who has the supervision of a plant of this kind. To begin with: We find a general description of such terms as current, potential conductors, insulators, and resistance. Following we have the unit of electrical measurement, the "volt" defined, and from thence are carried on to Ohm's law, the fundamental one of electrical science, viz., that the current strength varies directly as the electro-motive force, and inversely as the resistance. Parallel circuits and resistance coils are next touched upon, and illustrations of resistance boxes introduced. The term "watt" is explained as being synonymous to "horse-power," 746 Watts, the equivalent, being referred to as the electrical horse power. Primary batteries come in for a share of attention, and illustrations of various kinds are found. The elementary principles connected with solenoids, and the transmission of current through them are next treated, as also the tangent form of galvanometer. We then find the mysteries of the term "shunt" explained, as also dynamometers, ammeters, &c. The sixth is an important chapter on the measurement of electro-motive force. The question of electro-magnetic induction is afterwards gone into very closely, and from there we are taken on to the theory governing the action of a dynamo-electric machine with an alternating current. The various ways of making a more powerful machine are noticed, and it is shown that to increase the strength of the field is the best means of attaining the desired end in view. We are thus brought to several forms of alternator, and these are all illustrated after the best manner, the last being the latest pattern of the Mordey Alternator. Following, there is the dyname machine with direct current explained in the most simple form first. The reader is then led by easy stages through the intricacies of "series dynamos" to "shunt-dynamos," and a combination of both forms. Compound winding then comes in for a share of attention before reaching actual examples of this type of machine. These again are all profusely illustrated, the losses in the armatures referred to, and "open" as well as "closed-coil" forms described. In this last connection the "Brush" and "Thomson-Houston" systems receive due notice. The reader next finds motors and their applications brought before him. He is led from their elementary principles to their regulation, rate of working, and efficiency. The best known forms are afterwards illustrated.

Another chapter treats of transformers, the name given to apparatus for converting power from a high to a lower potential, as may be necessary when transmitting long distances from a central station. A reader has all the best known forms before him in these pages, with directions for their regulation and safety. Nearly thirty pages are afterwards devoted to secondary batteries or accumulators. The two principal forms of these are found in detail, together with their capacities and efficiencies. Arc lamps and their elementary principles, followed by illustrations of actual examples, take up the fifteenth chapter, and next we have the incandescent system in the same way gone through with the method of manufacture. The different forms of photometer for measuring light are next described, and finally the reader is brought to the details of an installation, a very important section of the subject. Here conductors, modes of distribution, insulators, ways of jointing, underground mains, switches, magnetic cut-outs, fuses, meters, all find a place. At the end is a copious index of terms used throughout the volume. Our space has prevented us going more fully into the subject. We have endeavoured to give the outlines only of what the authors have introduced, so that those interested may know what to expect to find in the volume. Generally, it will be understood that nothing bearing upon the application of first principles has been omitted. A worker in this branch of science may thus meet with a reason and an example for all problems he may encounter. We cannot remember to have seen a book of a technical character better illustrated before. It should command a ready sale.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

FAST PASSAGES.

To the Editor of The Marine Engineer.

Sir,—As an interested observer of the discussion anent the above subject, which has been carried on for some time in your valuable columns, I am much struck with the poor defence set up by those correspondents who appear desirous of posing as shipmasters' champions. One cannot help thinking that a cause which builds its claims to honour and credit on such slight foundations must be inherently weak.

I allude more particularly to a letter under the same heading, but containing no reference whatever to the subject at issue, which appeared in your March number, signed "P. W. W.," and was intended as a reply to an article on the same subject which appeared in your February issue.

The writer of this reply is evidently a little mixed as regards cause and effect when he implies that W. L. P. is trying to stir up contention between the engine-room and bridges; the discord has, unfortunately, too long existed, and it is only by giving publicity to its cause that we can hope to effect its removal. His "peace at any price" recommendations, though commendable enough when two parties mutually strive to pull together, are scarcely practicable when one side is expected to do all the kneeling down.

If P. W. W. is not (as he implies) a seafaring man, then I submit he is not qualified to pass an opinion on these matters. If he is, I would advise him to sail a few voyages in a "Tramp steamer," where the victualling arrangements are in the hands of the captain, and live in the engineers' mess-room. If that does not knock the brotherly love doctrine out of his head, it will, I fancy, give it a severe shaking.

Our friend, who has neither a sister, or a cousin, or an aunt in the seafaring line, takes exception to the words "unscientific" and "illiterate" being applied to sea captains, conveniently ignoring the fact that the latter expression was qualified; but as a junior engineer, and as one who—like our friend—has also come across a good many tramp and coasting skippers, I must say I can conscientiously endorse the words in their entirety.

While on the subject, I would remark that if captains of vessels wish to retain even a shadow of that respect which they appear to be fast losing, they must act towards others fair and square, as becomes honourable men, and abandon those shady transactions so well known to ship chandlers and others of that kidney in our principal seaports. Respect is a plant that cannot be forced, not even by Act of Parliament, and the sooner shipmasters realise the fact the better will it be for both themselves and the prestige of the Mercantile Marine.

A Junior Engineer.

MARINE ENGINE TRIALS.

To the Editor of The Marine Engineer.

Dear Sir,—Allow me to call your attention to an error which appears in the Report of the Research Committee on Marine Engine Trials, in this month's issue of your paper.

Page 91, column 2.—Calorific value of this fuel as used is 12760 TU per lb., which is equivalent to the evaporation of 13·21 lbs. of water from and at 212° Fah. Carbon value of this fuel as used is 0·878 lbs. per lb.

Page 93, column 2.—Calorific value of fuel = 13,280 TU = evaporation of 13·75 lbs. of water from and at 212° Fah. Carbon value of this fuel 09·13 lbs.

Page 96, column 1.—Calorific value of fuel = 14,995 TU = evaporation of 15·52 lbs. water from and at 212° Fah. Carbon value of this fuel 1·031 lbs.

You will find that carbon value of fuel on page 93, column 2, should be 0 918. This is probably a printer's error.

Yours truly,
C. B. Casebourne.

West Hartlepool, June 6th, 1890.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from May 15th to June 13th, 1890.

7747	A. Anthony and H. Henry. Method of feeding marine or other boilers.
7750	T. Nicol. Firetight doors.
7888	J. T. Shipman. Metallic tubes for tubular boilers.
7967	G. Weir and J. Weir. Valves.
7995	W. P. Thompson. Apparatus for stopping the motion of steam engines.
8021	J. M. Hale. Ships, boats, and other vessels.
8069	S. Douglas. Propelling vessels.
8107	G. Wilson. Propelling vessels.
8120	E. Paine. Cleaning navigable vessels.
8247	E. A. E. Finckenstadt and G. Roy. Compensator for undue strains on ships' cables.
8267	C. E. Allaire, J. B. G. Gautier, and J. L. Poulard. Improved helicoidal propeller.
8290	T. Mills. Propelling vessels.
8328	T. A. McKee. Rotary engines.
8339	C. Hook. Anti-fouling compound for steam boilers.
8511	J. Burlinson. Gange glasses for boilers.
8701	T. Agudio. Boiler tubes for steam boilers.
8748	E. Jobling. Manhole doors for vessels carrying water ballast.
8926	S. Antonio de Castilho. Boat releasing gear.
8940	H. C. Ashlin. Oil-carrying vessels.
8963	W. H. O. Taylor. Valve gear for steam engines.
8996	J. A. Wade and J. Cherry. Lubricating shafts.
9003	W. G. Sell. Boats.
9105	B. J. B. Mills. Steam tow boats (A. McDougall, U.S.).
9127	E. G. M. Donnithorne. Reciprocating engines.
9186	W. Grimes. Steam boilers.
9188	J. Wallace. Marine governors.
9201	J. R. Werner. Marine governors.
9202	J. R. Werner. Metallic packing.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

May 23rd, 1890.

Batey, Robt. M.	2C	N. Shields
Bushell, Chas. E.	1C	,,
Carboni, Jas. R.	2C	London
Cleator, Chas. A.	2C	L'pool
Cooper, John R.	2C	N. Shields
Dickson David ..	2C	Glasgow
English, Geo. E.	2C	,,
Erichsen, O. M.	2C	N. Shields
Franks, John W.	2C	L'pool
Govan, Robt. ..	2C	Cardiff
Gray, Wm.	2C	Aberdeen
Griffiths, Alf. J.	1C	Cardiff
Haire, Chas. L.	1C	Glasgow
Hutchison, W. E.	1C	L'pool
Hunter, Alex. ..	2C	Glasgow
Laing Thos.	2C	Glasgow
Lowden, Wm. L.	2C	,,
Major, Saml. A.	2C	L'pool
McCoan, Jos. W.	2C	Cardiff
McGregor, D. ..	1C	L'pool
McMillan, D. J.	2C	Glasgow
Milne, John	2C	Cardiff
Pithie, Richd. ..	1C	London
Potts, William ..	1C	N. Shields
Pringle, Wm. ..	1C	Glasgow
Rundle, H. P. ..	1C	Cardiff
Stewart, G. L. ..	2C	Aberdeen
Suddes, H. F. ..	2C	N. Shields
Thomas, John ..	2C	Cardiff
Torrance, R. H.	2C	Glasgow
Twomey, Jer. ..	2C	Cork
Weldon, H. H. ..	1C	L'pool
Williams, David	1C	Cardiff

May 30th, 1890.

Allan, Thos.	1C	L'pool
Anderson, J. ..	2C	Sunderl'd
Ashmond, A. N.	1C	,,
Barrasford, T. ..	1C	N. Shields
Bellam, John R.	2C	Sunderl'd
Cockburn, Thos.	2C	N. Shields
Cory, Sydney ..	1C	Sunderl'd
Daniel, F. G. ..	1C	Cardiff
Dickinson, Wm.	1C	L'pool
Dove, Richd. ..	1C	Sunderl'd
Gassap, John H.	1C	London
Gifford, Robt. ..	1C	N. Shields
Gregory, Wm. ..	2C	Sunderl'd
Kay, Samuel ..	2C	L'pool
Kermonde, Jas.	1C	,,
Kilburn, Adam	1C	N. Shields
Lee, Ernest A. ..	1C	London
McDonald, Wm.	2C	L'pool
McKendrick, Jos.	1C	,,
Millar, David B.	1C	,,
Moonan, H. F. ..	2C	London
Pain, Edwd. A.	1C	Sunderl'd
Sherwin, A. W.	1C	L'pool
Stap, H. F. J. ..	1C	Falmouth
Stark, J. M. ..	1C	London
Strathorn, John	1C	,,
Swin, Harry ..	2C	N. Shields
Topping, John G.	2C	London
Turner, Wm. F.	1C	,,
Warren, George	1C	,,
Wheatley, Geo. P.	2C	N. Shields
Young, John McD.	2C	London

June 6th, 1890.

Black, Thos. ..	2C	Glasgow
Boyd, Wm. ..	1C	Greenock
Brander, James	2C	Greenock
Davies, Wm. Ed.	1C	London
Deacon, Henry	1C	Liverpool
DeGruchy, A. S.	1C	Greenock
Foggie, A. H. ..	1C	Leith
Fulton, Wm. G.	2C	,,
Hamilton, J. K.	1C	Glasgow
Harrison, Henry	2C	Dublin
Hean, A. G.	2C	Liverpool
Hutton, J. C. ..	2C	N. Shields
Jack, Robert ..	2C	Leith
Jobson, Alexr. ..	1C	N. Shields
Kerr, James	2C	Greenock
Kinghorn, R. E.	2C	Glasgow
Longhurst, Geo.	2C	Leith
Mansfield, W. J.	2C	Liverpool
Main, Peter G. ..	2C	Leith
McCartney John	2C	Greenock
McCormack, J.	2C	Glasgow
McDonald, John	1C	,,
MacFarlane, J.	1C	Glasgow
McFarlane, R. ..	1C	Greenock
McGhee, Wm. ..	1C	,,
McGill, John ..	2C	N. Shields
McGowan, J. P.	1C	Greenock
McKenzie, Geo.	2C	N. Shields
McLaren, R. S.	2C	Glasgow
Paterson, A.	1C	Leith
Paterson, Wm. ..	2C	Glasgow
Reed, John	1C	London
Ross, Hy. Jas. ..	1C	Glasgow
Rowan, T. W. ..	1C	Leith
Stark, Robt.	2C	,,
Strachan, Wm.	2C	Glasgow
Thompson, C. ..	1C	Greenock
White, Geo. Jno.	2C	N. Shields
Wilson, Wm. ..	2C	Glasgow
Wright, Geo. R.	2C	Glasgow

June 13th, 1890.

Ashton, Edwd. C.	2C	London
Bovey, John	2C	Plymouth
Bradley, Thos. ..	1C	London
Brown, Walter	1C	,,
Carrick, Wm. C.	2C	N. Shields
Claydon, James	1C	,,
Crandell, Walter	2C	London
Crockett, Alexr.	2C	Dundee
Fitzgibbon, John	2C	London
Glapel, Geo.	1C	W. Hrtlpl
Gloak, John	2C	Dundee
Gutcher, George	2C	N. Shields
John, Thos. H.	2C	London
Johnson, Chas.	2C	W. Hrtlpl
Kirk, John W. ..	1C	Plymouth
Lowson, Wm. ..	2C	Dundee
Lumby, A.	2C	Liverpool
Owen, Robert ..	1C	Liverpool
Paxton, R. F. ..	2C	N. Shields
Penn, Alexr. W.	2C	Liverpool
Peet, Wm.	2C	W. Hrtlpl
Pottullo, David	2C	Dundee
Rendall, Saml. ..	2C	Plymouth
Ross, John	1C	Liverpool
Rowe, Joseph ..	1C	Falmouth
Skinner, E. H.	2C	N. Shields
Stone, Wm.	2C	London
Trewhite, Chas.	2C	W. Hrtlpl
Turpie, Roger ..	2C	Liverpool
Turnbull, Wm. ..	1C	W. Hrtlpl
Wake, Wm.	1C	,,

June 20th, 1890.

Andrew, Samson	2C	London
Beacroft, Geo. F.	1C	L'pool
Bell, Geo.	2C	N. Shields
Bird, John L. ..	2C	London
Blethyn, Jno. J.	1C	Cardiff
Boggon, C. P. ..	2C	N. Shields
Burnham, O. T.	2C	L'pool
Christie, W. G.	1C	,,
Cook, Alexr. ..	1C	N. Shields
Cook, G. W. P.	2C	,,
Crawford, Robert	1C	Glasgow
Douglas, John ..	2C	,,
Dougles, Robert	2C	N. Shields
Ewart, Fred. J.	2C	,,
Gledden, F. W.	1C	,,
Gordon, Jno. C.	1C	Aberdeen
Graham, Jos. S.	1C	L'pool
Hannan, Jas. ..	2C	Glasgow
Henderson, Wm.	1C	Aberdeen
Leyshon, W. R.	2C	Cardiff
Lloyd, Robert ..	2C	L'pool
Martin, Thos. H.	1C	Cardiff
McPhee Duncan	2C	L'pool
McWhannel, R.	2C	,,
Moore, Jas. H. ..	2C	N. Shields
Murray, Chas. W.	2C	London
Paterson, Jas. ..	1C	Glasgow
Purvis, Robt. C.	2C	N. Shields
Reid, Alexr. ..	1C	Glasgow
Roberts, Robt. W.	1C	Cardiff
Ross, Daniel ..	2C	Glasgow
Smeal, Joseph ..	2C	,,
Smith, N. J. ..	2C	Cardiff
Spence, David C.	2C	Glasgow
Sutherland, D.	1C	Aberdeen
Thompson, C. W.	2C	Aberdeen
Walters, J. H. ..	2C	London
Williams, Jno.	1C	L'pool
Williams, Walter	2C	Cardiff

The Junior Engineering Society.—Professor John Tyndall, LL.D., F.R.S., has accepted the position of Vice-President of this society.

The Marine Engineer.

LONDON, AUGUST 1, 1890.

ELECTRICAL installations are now forming so important a part of passenger vessel fittings that it behoves us to consider and discuss any subject of interest in electrical engineering applicable to marine engineering. We are glad to see that the Institute of Marine Engineers has encouraged Mr. R. E. Crompton to read a lengthy paper before that institute, in which Mr. Crompton, from his well-known and extensive experience, defined and introduced to the attention of the institute certain primary and essential conditions that have to be borne in mind for an efficient electric-lighting installation. He endeavoured to combat very well rooted prejudice in engineers' minds against excessively high-speed engines, in order to obtain the desired high speed of the electrical dynamo machine. It is generally recognized (and truly) amongst engineers that high speed means an increase of wear and tear, with consequently a rapid deterioration and danger of excessive heating, should any of the bearings accidentally run dry. There is little doubt that engineers are fully justified in their objections technically to high speed reciprocating engines, as the mere setting in motion and stopping of reciprocating parts, not only uselessly absorbs energy, but tends to make the wear and tear upon the bearings excessively greater than in a continuous motion, and develops a marked tendency to cause knocking under wear. We should like to see such excessively high-speed engines, as might be required for driving dynamos direct, developed in a rotary form, but this class of engines has too frequent a character of being steam-eaters, that is, very uneconomical in their consumption of steam. The value to an electric dynamo generator of high-speed for the development of a required electro-motive force is however so marked, that high speeds must be employed at any cost; in fact, Mr. Crompton gives it, that for various ranges of speed to produce a certain efficiency of current, the cost of the dynamo will rise proximately in inverse proportion to the speed of running. In the development of an electrical energy, speed is equivalent to magnetic force, thus requiring a minimum of fixed magnetic field and a minimum of material employed. Thus we have to face as a mechanical desideratum, the fact that dynamos should be run at speeds of from 800 to 1,600 revolutions per minute, speeds which are far in excess of those usually employed with reciprocating steam-engines. This speed is usually obtained by gearing down from the engine to the dynamo by cog-wheels, rope, or belt gear, so that the dynamos may run at a much higher speed than the steam motor. It is known, however, that high-speed gearing is liable to chatter and be noisy, and thus to develop unexpected fracture, though we believe this evil might be greatly lessened by the cog-teeth being much more carefully cut and formed according to the true theoretical curves than is done at present. Rope or band gearing is also very liable to slip where the driving pulleys are reduced to small diameter. These various considerations are all appropriate to marine engineers, who, by due consideration of the points of view to be obtained for maximum efficiency of lighting apparatus, may thus be able to more readily suggest and desire specific arrangements of driving to meet their personal views. We should much like to see a good and economical rotary engine introduced for this purpose. Mr. Crompton gave other information as to the systems of single and double wiring, and of precautions which should be taken for the protection of such leads. There is no doubt there is much still to be desired in the care and intelligence with which installations should be laid. One case was cited by a member present of a petroleum ship, in which a fire was caused through the installations being damaged and moisture reaching the wire, which was then eaten through by the action, and the ends of the broken wire generated sufficient heat to cause ignition. Such examples will serve to impress upon engineers that the utmost precautions should be taken to prevent liability to such accidents.

AN extraordinary stimulus has been given to the development of inland navigation since the inauguration of the Manchester Ship Canal, and no more fitting centre could have been selected than the above city for the fourth International Congress on this important subject so vitally connected with the future expansion of the industrial enterprise of this country. Manchester represents perhaps the foremost centre of British industrial progress, and has taken the lead not only in recognising the enormous advantages of cheaper means of transit by water carriage, so long neglected in this country, but has taken the practical step of securing these advantages, by carrying out one of the most gigantic schemes of inland navigation that have been projected in modern times. It is an old political saying that what Lancashire thinks to-day, England does to-morrow, and it is not surprising that the successful inauguration of so important a work as the construction of a ship canal from Manchester to the sea should be followed by the promotion of similar enterprises in other parts of the country. It is only necessary to briefly mention one or two of the principal schemes of inland navigation to which the

Manchester Ship Canal has practically given birth to demonstrate how important and far-reaching the effect is likely to be in improving the means of transit from many of the inland centres of manufacture and commerce to the sea coast. Amongst the first of the projects to follow the conception of the Manchester Ship Canal was the improvement of the water-way from Preston to the sea, and although that project has been delayed in its carrying out by errors of judgment which marred the success of the scheme at the outset, the Preston Corporation have obtained powers for the expenditure of further money towards its completion, and there is no doubt that eventually it will become an important water-way to a large and rapidly expanding centre of industry. Another scheme is that of the Sheffield and South Yorkshire Navigation, for which parliamentary powers have already been obtained, with the object of improving the Dun and the canals in connection with it; the Sheffield Canal; the river Dun Navigation; Dearne and Dove Canal; also the Stainforth and Headly Canal; and the promoters have deposited £20,000 as an earnest that they intend carrying out this important work of improving the present navigation, so as to make it available for barges up to 300 tons. The people of Birmingham are also following in the footsteps of Manchester, and intend applying next session of Parliament for powers to acquire such canals and navigations as will bring them in connection with the Manchester Ship Canal, for the purpose of providing a water-way for barges up to 300 and 400 tons, a scheme which will utilize both the Weaver Navigation and the Manchester Ship Canal. Another scheme which is also being projected by the people of Birmingham is to acquire the Gloucester and Berkeley Canal and the Worcester and Birmingham Canal, also to utilize the Severn Navigation, with a view of bringing Birmingham in direct connection with the Sharpness Docks for barges of about 200 tons, and in another direction powers have been obtained for the improvement of the Trent from Nottingham to the river Humber. All these various schemes are unmistakable indications of the awakening interest in the importance of inland navigation, and the question of improved facilities for transit by means of water carriage, which is now occupying so much of the attention of the manufacturing and trading communities of this country, cannot fail to receive an additional and powerful stimulus from the Manchester International Congress on Inland Navigation. Previous conferences on the same subject have been held respectively in Brussels, Vienna, and Frankfort-on-Main, and the Congress which has commenced its sittings in Manchester will not be less important than any of its predecessors. The objects which the Congress have specially in view are to promote the improvement of inland navigation and of estuaries, to direct attention to the economical value of navigable waterways; to examine generally technical questions relating to the construction and working of canals; to receive the report of the International Statistical Commission appointed at the last Congress, and to take further steps towards the collection of statistics bearing on inland navigation. The work of the Congress is divided into two sections, the first being devoted to engineering and the second to trading and economy. In both these sections papers have been contributed by the leading authorities on inland navigation, both of this country and abroad, and amongst the subjects specially being dealt with in the engineering section are "Inland Navigation and Canalised Rivers," embracing the Welland Canal, Aire and Calder Navigation, the Weaver Navigation, the Volga and Baltic Navigation, and the present condition and development of inland water-ways in England. Other sections are dealing with traction and propulsion on canals, and dredging and excavating. Ship canals and tidal river works are also the subject of several papers in which the Manchester Ship Canal, the Nicaragua Canal, the Baltic Canal, the Amsterdam Canal, and the Corinth Canal are being dealt with, whilst with regard to the improvement of tidal rivers the principles upon which these improvements should be carried out, and the action of tides and estuaries, are being set forth. In the section devoted to trading and economy, the condition, management and cost of working of inland navigation in France, Germany, Austria, Russia, Italy, Switzerland, Sweden, the Netherlands, Spain and Belgium are being dealt with, and other subjects under consideration are the present position as regards finance and traffic of inland navigation in the United Kingdom, the cost of transport on canals as compared with railways, and the extent to which the State should assist or share in the development or management of inland navigation traffic. During the sittings of the Congress excursions are being made to various points of interest in the district, one of the chief of these being necessarily the works of the Manchester Ship Canal, which were visited by a numerous party of members on Monday last.

SHIPOWNERS having made a stick with which to have themselves beaten, in the shape of the Life-saving Appliances Act, it is a curious spectacle to see how persistently and adroitly they seek to avoid or stave off its legitimate operations. They have—or at least a section of them have—memorialized and petitioned the Board of Trade officials ever since the issue of the rules based upon the Act, with the view of seeing whether certain of the provisions could not be repealed or modified; and, in effect, the Board of Trade have replied: "You yourselves have made the rules, and you must abide by them." The latest, and probably the last attempt to effect a modification in the provisions in question, was made in Parliament on the 14th ult., when Dr. Cameron, as representing the Glasgow and West of Scotland owners, and Mr. C. Wilson, as speaking for the North of England and other districts, asked whether it was the intention of the Government to enforce the Life-saving Appliances Rules in respect to the coasting, Continental, and short over-sea trades, in spite of the objections raised by the shipowners interested, those objections being fully explained in a statement transmitted to members of Parliament from a meeting held at Glasgow on the 8th July. Sir Michael Hicks-Beach, in effect, replied that the rules in question had been prepared by a Statutory Committee appointed under the provisions of the Merchant Shipping (Life-saving Appliances) Act, 1888, said committee consisting of three shipowners selected by the Council and the Chairman of Shipping, one shipowner selected by the Shipowners' Association of Glasgow, and one shipowner selected by the Liverpool Steamship Owners' Association and the Liverpool Shipowners' Association conjointly, two shipbuilders selected by the Council of the Institution of Naval Architects, three persons practically acquainted with the navigation of vessels selected by recognised shipmasters' societies, three persons being or having been able-bodied seamen selected by recognised seamen's societies, two persons selected conjointly by the committee of Lloyd's, the committee of Lloyd's Register Society and the committee of the Institution of London Underwriters,—Mr. F. H. Ismay acting as chairman. It is upon the report prepared by this representative and eminently capable committee that the rules issued by the Board of Trade are based. In effect they provide that in one form or another life-saving provisions shall be made for all persons on board a vessel. The rules as first issued have undergone revision and modification at a second sitting of the Statutory Committee as the result of representations made by the very same parties again craving modifications. After exhaustive reconsideration of the case, the committee came to the conclusion that the rules as now modified are practicable and necessary in the interests of public safety. Surely, therefore, shipowners should now be expected to realise that the recommendations thus reaffirmed cannot be disregarded or made free with until, at least, practical experience has shown that they are unworkable or superfluous.

WE have been favoured with a copy of a communication to the Prime Minister from the hands of that well-known naval critic, Sir Thomas Symonds, Admiral of the Fleet. He has long been pressing upon the attention of the Government and the nation his opinion that the Empire of Great Britain is by no means so adequately represented as a naval power as it was in the beginning of this century, during which it is universally admitted that Great Britain only existed by virtue of her undisputed control of the seas. There is no doubt that the general conditions of trade and the character of our fleet has so entirely altered in the past century that our necessities for such adequate control of the seas may be infinitely more imperative at the present time than in bygone years. Admiral Symonds has taken great trouble and pains to make himself actually acquainted with the definite statistics, so that he no longer presents a mere opinion to the Government and country, but certain facts, from which he leaves his readers and the country generally to draw their own conclusions. Two startling facts which he brings forward as a basis for comparison of our present position with that of the beginning of the century are these:—1st. That our sea-going commerce is now twenty times as great in value as it was in 1793. 2nd. In 1813 we appeared to have had, on good authority, 131 battle-ships and 578 cruisers in commission and building, making 709 in all. Allison states that during our struggle with what we may consider nearly the whole of Europe, during the time of Napoleon I., the British Navy amounted to no less than 1,061 ships of war. England had some 240 vessels of the line in her service as against 180 line-of-battle ships in the service of all Europe. At present we seem only to have some 355 sea-going vessels and 156 armed boats in the Navy, making our total about 511 in all, and the height of ambition of the Government and country seems to be limited to the British fleet being maintained at a strength equal to any two Continental Powers taken together. These figures, taken as they stand, are truly startling as we are certainly as a nation very dependent upon our commercial marine for even food and nearly all the necessaries to which we are accustomed. Although it may be advanced that the monetary value of our present navy is much higher than the former value of a similar number of vessels of the old wooden sailing type, yet this objection hardly meets the argument that we must maintain a relative superiority to other nations, such as we have had before, in order to maintain with any certainty an assurance that we can continue to control the seas. The introduction universally of steam power into the navy has also materially altered the conditions under which a fleet can keep at sea. In Nelson's time he remained at sea for so long a period as two years at a stretch, whereas it is stated that in many cases of our cruisers of small tonnage they will be obliged to re-coal at short intervals. Unless we have absolute control of the seas throughout the world how is it possible to ensure that foreign coaling stations are kept supplied. If by control of the seas in former years England was able to wrest colonies from all other Powers, is it not probable that should we once lose control of the seas our colonies will soon be wrested from us? We only see one solution of the difficulty—it is entirely a question of £ s. d., and is an open question whether we are to place the navy as an insurance investment before the army, instead of *vice-versa*, as is at present the practice. The colonies and India also should be urged to see the importance in conjunction with the mother country of an absolute command of the seas, and that the possibility of maintenance of their independence or present association with the British Empire will entirely depend upon the control of the seas by the British Empire. The very argument used by the Prime Minister with regard to the Island of Heligoland, viz., that its possession in any case depends entirely upon the control of the seas, applies equally strongly to this general question, and we do not despair yet of seeing such action taken by our confederated colonies and India as will enable us to maintain an imperial fleet which might without difficulty be at least double its present numbers. Sir Thomas Symonds also criticises very strongly the efficiency of our fleet, as expressed on paper, discrediting many of our types of cruisers as being practically unfit for sea-going purposes. This subject is too complicated to discuss in detail, and will always be no doubt a matter of opinion, and if we are to judge from a late report emanating from a member of the French navy we are at least as well off as our neighbours. We think that quibbles over details of designs and relative construction are all very minor matters as compared with the vital question whether the estimate of the position we ought to occupy to ensure a control of the seas, which we may all admit is a necessity to our existence, is lamentably underrated or not.

THE ECONOMICS OF INLAND TRANSPORT.

As the Fourth International Congress on Inland Navigation is now being held in Manchester, the precedent meetings having been held in Brussels, Vienna, and Frankfort-on-Main, it is a fitting opportunity to survey the existing economy of inland transport in the United Kingdom. Evidence is not wanting that our competitors on the continent of Europe and in the United States are sparing no pains in developing their industrial resources. It is becoming more evident every day that the industrial interests of this country, the like of which is unparalleled in the history of mankind, can no longer afford to smile complacently on the keen efforts made by our competitors who neglect no improvements likely to facilitate and cheapen inland transport. As the natural consequence the cost of inland transit is much less in continental countries than in the United Kingdom. In this connection the following extract from the *Edinburgh Review*, October, 1883, will be found instructive:—"What at last awakened the industrial world, and that with a suddenness probably without example, was the fact that the English manufacturer, finding himself unexpectedly undersold, not only in the foreign but even in the home market, betook himself to investigate the cause. That cause he soon found was that he paid in many cases twice as much for transport as did his continental neighbour." In a report prepared at the instance of the Association of Chambers of Commerce by Sir B. Samuelson, M.P., dated December, 1885, on the Railway Goods Tariffs of Germany, Belgium, and Holland, compared with those in this country, the following examples among many others are given:—

	Rate per Ton. s.	d.
Pig Iron.		
Cleveland to Manchester	8	4
Same distance in Germany	4	11
,, ,, Belgium	4	2
,, ,, Holland	4	11
Bar Iron.		
Brettel Lane to Manchester	11	6
Same distance in Germany	7	0
,, ,, Belgium	6	4
,, ,, Holland	7	3
General Machinery.		
Leeds to Hull . (export, 12s. 6d.)	25	0
Same distance in Germany	4	6
,, ,, Belgium (export, 5s. 5d.)	8	0
,, ,, Holland	5	6
Hardware.		
Birmingham to London	19	4
Same distance in Germany	10	0
,, ,, Belgium	12	9
,, ,, Holland	10	4

No wonder when the foreign manufacturer is enabled to have his raw materials as well as his finished goods conveyed at rates so much cheaper than our manufacturers at home, that old-established staple industries have been compelled to migrate from the inland districts to the sea-board in order to avoid the incidence of oppressive transport charges. One of the oldest engineering firms in Manchester, Messrs. Sharp, Stewart & Co., have removed their extensive locomotive business to Glasgow owing to this very cause; another extensive establishment, the Manchester Steel Works, was closed some years ago for the same reason. A large sugar refinery in Manchester relinquished business simply because competition with Greenock on the Clyde could not be sustained. Messrs. Wilson, Cammell & Co., the well-known steel rail makers, migrated from Dronfield near Sheffield to the sea at Workington, on the coast of Cumberland, in order to avoid the excessive railway charges.

A flood of light is thrown on the cause of the oppressive charges levied in this country by clause 43 of the draft report of the select committee of the House of Commons, 1881-82, appointed to inquire into Railway and Canal Rates, the terms of which are as follows:—"With regard to the traffic on canals, serious, if not numerous, complaints were brought to the notice of your committee. It was alleged that the dealings of some railway companies with canals, owned or controlled by them, are obstructive, that it is difficult to compel railway companies to keep their canals open and fit for traffic; that the tolls charged on these canals are higher than on independent canals, or on the same canals before they passed into the hands of the railway companies, and that these high tolls act as bars to the traffic of other canals forming part of the same line of through communication. In short, that the check upon railway monopoly of transport, which the competition of rivers and canals maintains in France, Germany, Belgium, and other countries, is fast vanishing from this country, and that the external water competition, afforded by the sea, does not by any means completely supply an equally efficacious check." The inquiries of this parliamentary committee resulted in the accumulation of a vast amount of evidence, illustrative of the alarming effects on our trade which are inseparable from the existing monopoly of inland transport by the railways. As a very little relief can be hoped for from the interference of the legislature, the only effective method of disturbing this monopoly is to subject the railway companies to a strong healthy competition of a kind which they can neither bribe nor extinguish. As things are at present one is seriously led to consider whether the railways exist for the public or the public simply to oblige the railways. The present railway policy is certainly that of "killing the goose that lays the golden egg." This strong, healthy competition is water transport, and especially as regards inland navigation. This is well evidenced by one of the most eminent authorities on inland transport, Sir Richard

Moon, the chairman of the London & North-Western Railway, who stated, at the half-yearly meeting of that company in February, 1882, that:—"The sea and canals did more to bring down railway rates than any competition amongst the railways themselves." The railways can, undoubtedly, excel canals in speed. Speed is a *sine qua non* as regards the conveyance of humanity, with reference to the bulk of commodities it is immaterial whether they are carried four miles an hour or forty miles. On the railway system of the United Kingdom the volume of traffic conveyed during the year 1888 amounted to 281·75 million tons, of which ordinary merchandise and minerals formed respectively 80·17 and 201·58 million tons. The respective contributions to gross revenue were £21,239,841 and £16,158,881. The relative proportions of the volume of traffic were 28·5 and 71·5, the relative contributions to gross revenue being as 57·9 and 42·1. The gross earnings on ordinary merchandise average 5s. 2⅓d. per ton and on minerals 1s. 7¼d. per ton. The annual returns made to the Board of Trade make no reference to the net earnings individually as between ordinary merchandise and minerals. As regards mineral traffic there is strong presumptive evidence that, taken in the aggregate, it is carried at a loss. The late Mr. J. Grierson, the general manager of the Great Western Railway, one of the chief mineral carrying lines, handed in to the select committee on Railway and Canal Rates, 1881-82, a statement showing that the cost of mineral terminals on that system averages 2s. 2$\frac{7}{10}$d. per ton. Under such a condition of things, seeing that at the time that statement was handed in the average receipt on every ton of mineral carried was only 1s. 9¼d., and in 1888 only 1s. 7¼d., it is obvious that the mineral traffic must be carried at an enormous loss. In order to make up dividends, higher rates must necessarily be charged upon ordinary merchandise and passenger traffic in order to compensate for the loss upon the mineral traffic. Half a century ago, when the railway system was in its infancy, J. R. McCulloch, in his celebrated Dictionary of Commerce and Navigation, observed: "In as far as respects the conveyance of heavy goods, we believe that canals are generally preferred. It is not very material whether a ton of lime or coal or of manure be moved with a velocity of three to ten miles an hour; at least, the advantage of superior speed would in such a case be effectually overcome by a small additional charge." In spite of this obvious consideration, patent to all the world, over 73 per cent. of the traffic on the railways as regards commodities, consists purely of minerals. As a general proposition it may be stated that maintenance of works, and the depreciation in the value of the vehicles of conveyance costs fivefold the corresponding charges on canals. As regards maintenance of way there are no similar charges such as the renewal of rails on waterways. Haulage and other traffic expenses, and general charges on waterways only amount to one-half the cost upon railway transport. Another important advantage favouring inland water transport is that owing to the greater capital outlay necessary on railways, the interest charge is about three times as great as in the case of canals. Mr. Findlay, the general manager of the London & North-Western Railway, during the parliamentary inquiry into the merits of the Manchester Ship Canal, stated that out of the rate of 9s. 2d. per ton which his company received for the carriage of bale and case goods, after deducting cost of collection in Manchester and delivery in Liverpool, and the charges included under the name of terminals—the terminals being specifically stated to amount to 4s. 8d. per ton—that only 1s. 9d. remained to the company to cover the actual cost of haulage for 31½ miles between Manchester and Liverpool. Since this avowal was made a further reduction, making the second directly referable to the moral influence of the Manchester Ship Canal movement, has been made. Deducting this further reduction, amounting to 1s. 2d. per ton, it is obvious that 7d. only can now remain to the railway company for the haulage. This brings us to another material advantage presented by waterways. At almost any point alongside the bank boats can load or discharge instead of, as on railways, at fixed stations; this, of course, considerably lessens the cost of terminals. In this connection there is another important consideration to be taken into account in a comparison of the economies of railway and canal transport. At the terminal stations of railways there are miles of sidings required for the sorting of the traffic and the combination of trains. These sidings considerably add to the cost of terminal charges. The terminal accommodation required by canals dwindles into insignificance when contrasted with that necessary for railway traffic.

Up to the 1st day of January, 1889, when the Railway and Canal Act, 1888, came into operation, the Board of Trade had no power to compel Canal Companies to make annual returns of traffic, revenue, expenses, capital, interest, dividend, &c., such as the railways have had to do. Such returns must now be made every year, but such as have been made will not be published for some time, as grace has been allowed to such canal companies as have not already complied with the Act until August 10th, 1890, to send in returns for 1889. From a Parliamentary Return relating to navigation and canal companies, ordered to be printed by the House of Commons on April 26th, 1870, it appears that upon twenty-nine inland navigations in England and Wales, with a collective length of 1,390 miles out of an ascertained aggregate length of 3,670 miles, 21,250,000 tons of ordinary merchandise and minerals were conveyed during the year 1868. Dividing the volume of traffic by the mileage, the average works out 15,287 tons per mile. During that year the average of traffic per mile conveyed upon the railways of England and Wales was 10,544 tons. Returns were made by forty-two inland navigations in addition to the twenty-nine inland navigations referred, but the particulars of traffic were incomplete. The poverty of the information at command with regard to the economy of our inland navigation prevents a true comparison of the relative volumes of traffic conveyed respectively upon our railways and canals. It is interesting, however, that such information as is at command, although limited, shows that the waterways, as far as ascertainable, in England and Wales, secured an average volume of traffic per mile during the year 1868 almost one-half greater than the railways. As an illustration of the capabilities of narrow barge canals, the Trent and Mersey, which, as its name implies, connects those important rivers, is a forcible exemplification. Although only constructed with locks of 70 ft. in length, 7 ft. in width, and 3½ ft. in depth, accommodating vessels of 30 tons, that navigation was the medium of conveyance of 1,494,524 tons during the year 1868, the traffic user averaging 16,792 tons per mile, its length being 89 miles. The locks on the Bridgewater Canals system, which connects Manchester with Liverpool *via* Runcorn and the Mersey, and also with the Leeds and Liverpool Canal at Leigh, are 73 ft. long, 14 ft. 2 in. wide, and 4 ft. 6 in. deep, enabling the passage of vessels of 50 tons. Yet with this limited capacity, this system, which is 39¾ miles in length, has an annual volume of traffic amounting to 3,000,000 tons, the average traffic user per mile being 75,409 tons. The Bridgewater Canals system was acquired by the Manchester Ship Canal Company in August, 1887. It is interesting to note that the volume of traffic upon this canal system between Manchester and Liverpool is much greater than the traffic upon any of the individual railways, three in number, which connect these two cities. The Birmingham Canal Navigations system is another forcible illustration of a narrow barge canal system securing a large volume of traffic. Its ramifications in Midland counties extend over 169 miles, the barges conveying 30 tons, the volume of traffic in 1868 being 6,982,773 tons, the traffic user per mile averaging 41,318 tons. The Leeds and Liverpool Canal system, like the Bridgewater Canals system, is a barge navigation for vessels of 50 tons. It is 143¼ miles in length, traverses the industrial districts of Lancashire and the West Riding of Yorkshire, the traffic being about 2,400,000 tons per annum, averaging 16,000 tons per mile. It speaks volumes for inland water transport when 30 and 50 ton barge canals situate in the midst of railway competition can secure traffic users per mile greatly exceeding the traffic user per mile of the railways of the United Kingdom, which in 1888 was 14,231 tons. It is to be borne in mind that our artificial canals were principally made in the second half of the eighteenth century The dimensions of the canals were governed by the traffic requirements of that period. The general volume of trade was insignificant in relation to the enormous movement of commodities to-day. The idea of those elements in the successful development of the railway system, such as a common gauge, the interchange of running powers, and the arrangement of through rates, were probably outside the range of anticipation by the men of the latter half of the eighteenth century. Thus it happened in those times that every canal engineer was permitted to indulge in his own notions as to the appropriate depth, width and lengths of the locks. The result of these freaks is an inadvertent legacy of incongruities, which will require a considerable amount of correction to adjust our waterways to meet modern requirements. The railway system has taught us things which in turn one may with advantage turn to account in the development of our canal system. The principal portion of our inland navigation system is comprised in the quadrilateral, formed by the ports of Liverpool, Hull, London and Bristol, with the city of Birmingham in the midst. They are all placed in intercommunication by inland navigation. We can follow the railways by amalgamating the different links in the existing through routes, consolidating them under one administration for each individual route. To accomplish this much desired desideratum, the independance of our waterways must be secured, the administration of them to be reorganised, and adequate improvements made where necessary. Probably the best method of accomplishing these results would be the combination of the counties through which the great trunk lines of inland navigation pass, in order to acquire them by funds raised on the security of the county rates, the profits to be applied partly in reduction of the dues and partly in relief of the rates of the several counties concerned, a precedent existing in the case of the Weaver Navigation trust in Cheshire.

The Aire and Calder Navigation, connecting Leeds with Goole, probably affords the most perfect type of canal transport to be found in this country. The dimensions of the original locks were 58 ft. in length, 14½ ft. in width, and 5½ ft. in depth, adapted for barges of 60 tons. The present dimensions are 215 ft. long, 22 ft. wide, and 9 ft. deep. Steam haulage is in operation, and a tender can take through a lock at one lift eleven boats of special construction, each carrying 40 tons, a load in all of 440 tons. The services of only four men are required under this system, the ordinary method requiring the services of twenty-four men. On this navigation the cost of steam haulage has been reduced to $\frac{1}{34}$th of a penny per mile ordinary merchandise when hauled by tugs carrying cargo, the cost of steam haulage of minerals only costing $\frac{1}{16}$th of a penny per mile. Mr. James Abernethy, M.Inst.C.E., the well-known hydraulic engineer, stated before the Select Committee on Canals, 1883, in reply to inquires made by Mr. Thomas Salt, M.P., for Stafford, the chairman stated that such a canal as the Leeds and Liverpool could be rendered as efficient as the Aire and Calder Navigation at an outlay of £12,000 per mile; that the cost of the old canals of small type ranged between £7,000 and £8,000 per mile. He recommended a surface width of 66 ft., with a depth of 9 ft., the banks to be protected from the action of the waves occasioned by the passage of boats by dwarf walls about 2 ft. 6 in. below the surface of the water, with what is termed a slight rolling batter. It is quite clear that an expenditure of £20,000 per mile would cover the acquisition and cost of improvement and equipment of the suggested coast to coast through inland navigation routes. The average cost of the construction and equipment of the railways of the United Kingdom per mile up to 1888 amounted to £43,645. The provision of through routes on the lines suggested would enable the unit of conveyance to be increased from the average barge unit as at present in operation of 40 tons to 440, an increase of 1,000 per cent. As it is contemplated to lengthen the locks on the Aire and Calder Navigation to accommodate barge trains with 1,000 tons of cargo, a similar extension could be made on any through route where the traffic required it. Taking the mean load of goods and mineral trucks when the maximum load is carried as 9 tons, a train of 40 trucks would make a productive load of 360 tons. The improvements suggested would thus enable canals to be quite level in the competition with railways as regards the unit of despatch. On railways the resistance to be overcome by the locomotives is in exact proportion to the gross weight conveyed. On water the resistance is determined not by the weight but by the capacity of the vessel, and given a waterway proportioned to the dimensions of the vessels, the friction according to the size will increase as a series of squares, while the productive cargo increases as a series of cubes. Finally the potentiality of waterways in relation to expansion of traffic is ten times that of a pair of trucks on railways.

The most important development in inland navigation in this or any other country, by means of a purely artificial waterway, is the Manchester Ship Canal, which is now rapidly approaching completion. By enabling the continuation of an ocean voyage to the scene of consumption and production of the commodities which find occupation for sea-going vessels, the cost of inland transport is virtually done away with, the extra distance involved being infinitesimal in relation to the whole voyage. Under the Manchester Ship Canal Act, 1885, the maximum charges stipulated were based on the simple plan of taking one-half of the combined Liverpool port dues and of the railway rates to Manchester. This beneficial reduction of a clear 50 per cent. between ship and warehouse, works or mill, will not only place existing interests in a better position but will lead to new departures in connection with local industries of a most surprising character. Among these will certainly be the location of shipbuilding and marine engineering along the banks of the Manchester Ship Canal. In fact it may in truth be said that these industries are more carried on in the Manchester district. In Manchester workshops mechanism for her Majesty's warships has been constructed as well as screw shafts for the most powerful ocean liners. The shaft of the Inman steamer *City of Berlin* was made by the firm of Sir Joseph Whitworth. A well-known Manchester firm has recently commenced making marine engines and boilers on a large scale, and a Bolton firm has also commenced the manufacture of marine machinery. The contiguity of the coal supplies, the extent of the iron and steel trades, the presence of unrivalled skilled mechanical labour in the district, will all combine to ensure the foundation of an extensive shipbuilding industry with its dependent industries such as the construction of marine engines, boilers, propellers, ships' plates, anchors, pumps, masts, sails, loading and navigating machinery, tackle, and other marine appliances.

THE MANCHESTER SHIP CANAL.

APPROACHING COMPLETION OF ONE IMPORTANT SECTION.

As one portion of the Manchester Ship Canal Works, the important section from the entrance at Eastham to the Weaver, is rapidly approaching completion, and will in all probability be open for traffic early in next year, it will be interesting to give some brief description of what is being done. The work which is being performed is the ordinary canalisation of the rivers Irwell and Mersey from Manchester to Warrington, and below Warrington the construction of a tidal canal running along part of the estuary until deep water is reached at the head of the Sloyne on the Cheshire shore of the estuary opposite to Garston. There will be three entrances to the canal at Eastham arranged side by side, being respectively 80 ft, 50 ft., and 30 ft. in width, which at and near high-water will be opened as ordinary dock entrances; under other conditions of the tide these entrances being locks and of the lengths respectively of 600 ft., 350 ft., and 150 ft., vessels may enter and leave at all states of the tide, instead of only during high tide as at Liverpool. The Ellesmere Port Docks are on the Upper Mersey on the Cheshire shore, on the route of the Manchester Ship Canal nine miles above Liverpool. They form the terminus of the Shropshire Union Canals system. This system is a consolidation of the Chester, Ellesmere, Birmingham and Liverpool Junction, Shrewsbury and Montgomeryshire Canals, with an aggregate length of 204 miles. The imports at Ellesmere port consist of grain from Liverpool for the Midland counties, china clay, china stone, and flint from Cornwall, Devon, and Dorset for the Staffordshire potteries, iron ore from Lancashire and Cumberland ports for the Black Country. The exports chiefly consist of manufactured iron from South Staffordshire. The locks only accommodate long narrow barges of the old style, for passage to and from the Midland counties. The docks accommodate vessels up to 200 tons, and the annual volume of traffic is about 850,000 tons. The Shropshire Union system is really merged in the London and North-Western Railway Co. Under existing conditions vessels can only enter Ellesmere Port on spring tides. The Manchester Ship Canal will enable access at all states of the tides. The Weston Point Docks are on the Upper Mersey on the Cheshire shore on the line of route of the Manchester Ship Canal, 14 miles above Liverpool. They form the terminus of the Weaver Navigation, which is the shortest route to the potteries *via* Anderton Lift and the Trent and Mersey Canal. The imports at Weston Point consist of pottery materials, bone ash, hides, &c., the exports consisting of salt, stone, burnt ore, soda, and other chemicals. There is an extensive volume of traffic on the Weaver Navigation amounting to about 1,500,000 tons per annum, the bulk of which is salt. The navigation commences at Winsfords and extends to Weston Point, the distance being 24 miles. The locks are capable of passing in train 1,000 tons of cargo at one lift. The Weston Point Docks and the Weaver Navigation are vested in a trust representing the county of Chester, and the surplus revenue is supplied in relief of the county rates. The Weaver Navigation is one of the few instances of an inland navigation being adapted to modern requirements, and is of eminent service to Mid-Cheshire and North Staffordshire. Under existing conditions vessels can only enter Weston Point Docks on spring tides. The Manchester Ship Canal will afford access at all states of the tide.

In addition to the above particulars it will be interesting to add that the Manchester Ship Canal Co., by the Ship Canal Act, 1885, were constituted the harbour authority of the harbour and port of Manchester, and that the jurisdiction as a port authority extends from Hunt's Bank, Manchester, to the limits of the port of Liverpool at Warrington. There is a general impression that the Ship Canal ends at Old Trafford, Manchester, but as a matter of fact the largest ocean steamers will ascend to Woden Street footbridge. Above that point, simultaneously with the opening of the Ship Canal generally, the upper reaches of the Irwell will be bridged as far as Higher Broughton to such a depth as will allow steamers of 500 tons to reach as far as the Manchester Cathedral. The Mersey Conservancy consists of three Cabinet ministers *ex officio*—The First Lord of the Admiralty, the President of the Board of Trade, and the Acting Conservator of the Mersey. The Conservancy Commissioners were constituted by 5 and 6 Victoria, cap. 110. Under the provisions of this Act an acting conservator is appointed to advise the Commissioners in all matters concerning that portion of the Mersey between Warrington and the sea. In a geographical sense only is the Conservancy to be considered as having a local function. The Conservancy is an independent authority, subject to no local influence, and constituted in the general interest of the nation. In the portion of the Mersey under their control no works can be erected without the express consent of the Commissioners, whose powers enable them to deepen, widen, or otherwise improve the navigation, and to remove shoals, sandbanks, or other obstructions on their own account, or authorise the same to be done by others. The national functions which the Conservancy discharge are a sufficient guarantee that the great commercial interests involved will receive due consideration at the hands of the Conservancy Board, who will not allow themselves to be influenced in their judgment when any matter affecting the estuary is under their consideration.

For some time past the directors of the Manchester Ship Canal Co. have issued invitations to representatives of the various trades and industries, which are likely to be directly or indirectly benefited by the project when it is completed, to inspect the whole of the works from the docks at Manchester to the outlet at Eastham. Amongst the invitations they have included the representatives of the whole of the steamship interest engaged in the regular coastwise trade in or out of the Mersey, and a number of gentlemen connected with the various shipping companies were, a few weeks back, conveyed over the whole of the works, the party being accompanied by Sir Joseph C. Lee, the deputy-chairman of the Board of Directors, and Mr. Marshall Stevens, one of the officials of the company. Considerable interest was evinced by the visitors in the various portions of the works, and after lunch at Runcorn Mr. Thomas Gallagher, the chairman of the Belfast Steamship Co., in proposing success to the Manchester Ship Canal, observed that the undertaking was certainly one of the grandest he had ever seen or heard of, and he had no doubt that that was the experience and feeling of all present. The Ship Canal was an undertaking of which Manchester had great reason to be proud; it was a gigantic enterprise, and its promoters deserved the fullest support of all who desired the trade and commerce of the United Kingdom to flourish.—Sir Joseph Lee, in responding to the toast, said there could be no doubt that the Ship Canal would have a very important effect, not only upon the coasting trade of Great Britain and Ireland, but also upon the sea-going trade; that it would be a great waterway for freight and traffic—he did not say for passenger traffic—he thought they would all agree. It was not the wish of the directors to interfere unnecessarily with the existing trading interests; they hoped, however, the canal would be used by the gentlemen present and looked upon by them rather as an extension of their trade than as dividing in any degree the business they were carrying on. He might say, by way of illustration, that there were at least 1,000 tons of traffic per day passing from Manchester to London for which the steamers plying between Liverpool and London could not compete, but which on the completion of the canal the boats that the London line intended to put upon the Manchester "berth" would stand a fair chance of diverting.

ELECTRICAL ENGINEERING.*

BY MR. R. E. CROMPTON (HON. MEMBER).

I BEG that you will understand that I am a working engineer like yourselves, and not a professional lecturer, and this must be my excuse for my shortcomings, as I lack that practice and experience which enables lecturers to make a difficult subject clear to their audience. At the same time, as I myself was originally a mechanical engineer, and subsequently added to it the study of electrical engineering, my case is probably very much the case of many of those whom I now address, and it may be some help to you if I preface my remarks by giving a short history of how I, who was one of the first to take up electrical engineering in this country, became connected with it. About 13 years ago I had designed and carried out a large foundry plant for the Stanton Iron Works Co., in the Midland counties, and I was desirous of working this plant all night. The work was of a nature that required powerful lights, and as that same year I went with the Institute of Mechanical Engineers to see the Paris Exhibition of 1878, I heard a paper read on the subject of electric lighting, and made the acquaintance of Mr. Gramme, whose dynamo machines were at that time beginning to make a stir in the electrical world, and from him bought two sets of tackle consisting of dynamos and lamps. In order to make this plant work successfully I had to study the subject, and I assure you that at that time this was no easy matter. There were no text-books on the subject of dynamo machines and arc lamps; all that existed were a few notes on the discovery of the electric arc by Sir Humphrey Davy, and of the magneto-electric machine by Faraday, with its subsequent developments by Varley, Siemens and Wild. These did not much help one to find out why sometimes the Gramme dynamos would not give any current and at other times why the arc lamps burned excessively badly. For a long time it was a case of groping in the dark and getting experience from endless trials and failures. Compared with those *dark ages* our knowledge of electrical engineering *now* is very considerable, and I propose in my two lectures to bring before you a few of the useful facts that we have learnt, more particularly those you are likely to come in contact with in your profession. The subject naturally divides itself under two distinct heads. The first being the production of electrical energy, and, second, its distribution and utilisation. This evening I will confine myself to the production, or, as we generally call it the *generation of electrical energy*.

We used sometimes to talk of electricity as an electric fluid. We do so no longer, because we are by no means certain that it is a *fluid*, in fact we do not know what electricity is, but we do know that there are certain phenomena which act on our senses in a peculiar way and which we call electrical phenomena, and know that by employing certain apparatus in a certain manner, we can reproduce these phenomena, and, among others, we can reproduce a force which we call electromotive force, which for brevity's sake I will hereafter call E.M.F. E.M.F., like any other unbalanced force, produces what we believe to be motion of the particles acted on by it. We do not know anything of the nature of this motion, but we give it the name of an electrical current. The law which governs the flow of electrical currents is well understood. It was discovered by Ohm, of Munich, and it is to this effect, that the current varies as the E.M.F. which causes it, and the resistance to its passage through the conductors along which it flows. In other words, the current equals the E.M.F., divided by the resistance, or the E.M.F. is equal to the current multiplied by the resistance. Electrical energy or power is the product of the current multiplied by the E.M.F. The whole of our electrical engineering is connected with the generation and utilization of this electrical energy. Although, as I have said, we prefer not to speak of the electric fluid, yet what has been called the hydraulic analogy has been very generally employed by lecturers, who, like myself, are desirous of explaining to an audience of engineers the main features of the generation and distribution of electrical energy. Although this hydraulic analogy is not perfect, yet it is sufficiently so for our purpose this evening. I want you therefore to consider the electrical current as if it were the flow of a fluid through pipes, the speed of the flow being in proportion to the head or pressure produced by the generating machinery, which of course in the case of hydraulic machinery would be some form of pumping machinery. I have on the wall a diagram, No. 1., which illustrates this analogy. The kind of pump which is the nearest approach to the electrical pump or dynamo is the centrifugal pump, and my diagram shows a centrifugal pump circulating water through a system of pipes. The diagram shows the upper pipe, which may be called the pressure pipe, and the lower one the return, or the exhaust pipe. This last delivers into a well from which the centrifugal pump forces it into the pressure pipe, whence it returns by the various channels I have shown. These channels take the form of centrifugal pumps reversed, in other words, are turbines. In this way the energy which

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* Read before the Institute of Marine Engineers.

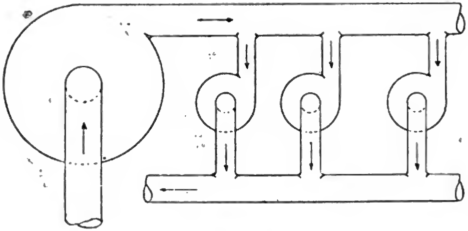


Fig. 1.

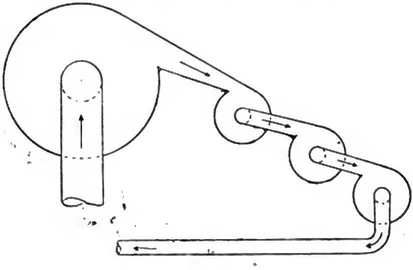


Fig. 1a.

was communicated to the water by this centrifugal pump, and which takes the form of pressure in the pressure pipe is partly reproduced in the form of mechanical energy at the spindles of the turbines. Of course there are many other ways in which the energy in the water may be utilised. Now if we substitute for the water what we call electricity and for the centrifugal pump the dynamo machine or electric pump producing E.M.F. or electrical pressure in the pressure main, and substitute for the pressure and exhaust mains two electric conductors we are able to reproduce the energy communicated to the electricity at the dynamo machine in the form of mechanical energy at the spindles of the electric motors, which take the place of the turbines shown on the hydraulic diagram. The analogy is not quite perfect, but it is sufficiently so for my purpose. You will see that after all, electricity itself is no more power than water itself is power. It is only a means of transmitting power, for just as surely as the power put into the centrifugal pump by its belt is transmitted by the means of the water to the belt of the turbine, so is the mechanical energy on the belt of the dynamo, transmitted by means of the electric current passing through the conductors to the belt of the electric motor on diagram No. 2. In fact, after all, we use electricity as a very long and flexible connecting rod which enables us to transmit energy to distances hitherto unthought of. I shall refer again to this hydraulic analogy when I come to describing the various modes of distribution of energy in my second lecture. I must tell you that electric currents are of two kinds, one comparatively easy to explain—the continuous current which is so greatly analogous to the flow of water along a pipe, and the second what is known as the alternating current, which is not easy to explain by the same analogy. The continuous current and its energy may be represented by the diagram No. 4, where the E.M.F. current and energy can be measured along the vertical line of the diagram, and the time along the base line. I think this is the time to name the terms that we use to designate electrical measurements. We measure current in Amperes, the E.M.F. in Volts. The resistance of the conductors to the passage of the current in Ohms, and the energy, that is to say the current multiplied by the pressure or the amperes by the volts, in Watts. One volt, multiplied by one ampere, equals one watt, and 746 watts equals one actual H.P. We electrical engineers wishing to use even numbers prefer to use the term kilowattor, or 1,000 watts instead of a H.P. It is equal to 1⅓ H.P. When electrical energy is sold by Act of Parliament, the unit of sale is one kilowatt for one hour, or which is equal to 1⅓ H.P. for one hour, and the present price of this in London is 8d. It is very easy to apply these measurements to the simple continuous current, but in the case of the alternating current the matter becomes rather more complex. An alternating current is one which alternates in direction at short intervals of time, that is to say, the generating machine produces an E.M.F. in one direction, for a fraction of a second, which causes a corresponding flow of current in that direction; it then reverses its direction and produces a corresponding E.M.F. and current in the opposite direction. In diagram Fig. 4 the continuous current is shown by the dotted horizontal line parallel to the base line. The distance between these two lines may correspond with the amount of current generated by the E.M.F. at command, which is shown by the thick line. In this di gram the measurements along the horizontal line represent time. If the current is perfectly continuous its line would be drawn exactly parallel to the base line, but in most cases it is slightly wavy, as very few generating machines give a perfectly continuous current. For instance, every beat of a steam-engine driving a dynamo is likely to cause a corresponding wave in the line, but for the purposes of my description we may take this line of current practically as a straight one. The thin upper line shows the current x E.M.F. in watts, and the area of the diagram enclosed between the base line and the energy line is the energy multiplied by time and gives the units.

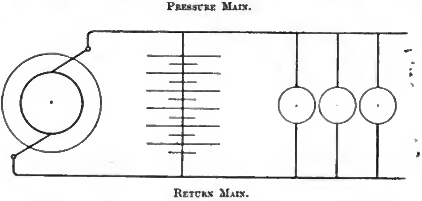


Fig. 2.

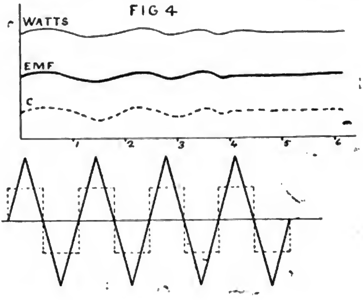


FIG 4

In the case of the alternating current, however, energy corresponding with that of the continuous current just shown would, when drawn along a base line representing time as before have to be shown as I have it here in the lower part of Fig. 4. You will see that the current mounts considerably beyond the distance between the two lines in the first diagram, descends again, cuts the base line, passes below it to an equal distance to that it previously passed above it, and so on, producing the wavy line shown. Although the alternating current is more difficult to describe, difficult to calculate and to deal with, it is the easiest one to generate by mechanical energy; in fact I may say that all currents when first generated are in the alternating form; they are afterwards commutated or redressed into the form of continuous currents by special apparatus called commutators, and as most of the machinery that is now used for ship-lighting is direct current machinery so commutated I will dwell more particularly on the machinery for generating such continuous or direct currents. Returning to the hydraulic analogy the duty of our electrical pump which we call the dynamo-machine is to maintain a sufficient E.M.F. or electrical pressure at its terminals to force the required current through the electrical conductors. I cannot pretend in the course of this lecture to go very deeply into the details of construction of dynamo machines. I can only attempt to explain to you the general principles on which they work, and the ideas which have governed the recent developments of the machines in which you are now likely to come in contact with. The production of E.M.F., and hence current in an electric conductor by means of mechanical energy was, as you all know, discovered by Faraday. He found that in the space which exists near or between the poles of a magnet, and which is generally called the magnetic field, the matter exists in a condition of strain; that if an electric conductor is moved through this magnetic field, E.M.F., and hence current, is generated in this conductor; he further found that this E.M.F. is proportionate to the strength of the magnetic field and to the speed at which the conductor is moved through it. All dynamo machines have been constructed with the end in view of producing as strong a magnetic field as possible and of moving the conductors in which current is to be generated through this field at the greatest practicable speed. A strong magnetic field is most easily produced in a closed iron ring. In this case the magnetic field is entirely inside the iron of the ring and consequently it is impossible for us to utilise it. Our nearest approach to it is to cut a slice out of the ring and if we can then cause a conductor to pass rapidly through the cut thus made we thus obtain E.M.F. in the conductor. Diagram Fig. 5 shows the very simplest form of dynamo machine constructed on this principle. The magnetic field is here produced between S and N, which may be the two sides of the cut ring, and the conductors that are moved through this field are arranged as spokes in a wheel. The circuit is completed by a rubbing brush or spring pressing against the centre boss of the wheel, and another brush rubbing against the end of the spokes. When the wheel is revolved by mechanical power at any desired speed, E.M.F. is generated in each spoke in turn, and causes an electric current to traverse the circuit connecting the two rubbing pieces in proportion to the total resistance of the circuit; for instance, if the machine I have shown in the diagram generated an E.M.F. of one volt in each spoke as it passed through the field, and that the entire resistance of the machine itself and of the wire connecting the two rubbing pieces is one Ohm., then the current that will pass will be one ampere. At present such a simple machine as I have here shown, is not used in practice, for the simple reason, as I have said before, that the E.M.F. produced (depending as it does upon the length of the conductor which traverses the field; the speed at which it traverses the field and the strength of the field itself); with this short spoke the results produced must be exceedingly feeble unless the machine was made on a gigantic scale.

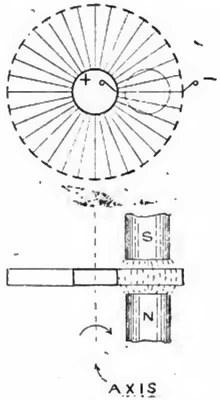


FIG. 5.

In practice we, by various arrangements succeed in producing the effect of a lengthened spoke by winding the conductor many times round the wheel, and this is not easy to do with this simple wheel, or disc-form of machine. Before however leaving it, I may tell you that probably the machine of the future is probably neither more or less than this wheel form of machine, the armature conductors being simple iron spokes; the difficulties I have above mentioned having been got over by using a great number of these spokes, and by an ingenious method of coupling the spokes together electrically at the centre and at the rim. The form of dynamos that are now most generally used, and which you most commonly meet with, are those in which the conductor, which has to pass through the field, takes the form of a long wire, wound on a cylindrical drum or ring. Turning to diagram, Fig. 7, we have here a machine of the ordinary form. You will recognise that the magnetic field is produced by the cut ring, or horseshoe magnet, and in this case, the conductors which cut the field are wound on to what is called a core, that is to say, a cylindrical mass of iron, which is placed free to revolve in a space bored out to receive it, between the poles of the magnet. This cylindrical shaped core which is formed of soft iron, and has a conductor wound on it, is usually called the armature of the machine. It is made in two forms, one called the plain drum armature, and the other, the ring or Gramme armature. The diagrams Figs. 8 and 9 show the difference between these two. In the drum form, Fig. 8, the core is a solid cylinder of soft iron, and the winding is passed longitudinally over its surface from end to end, and over its ends; whereas in the ring form, Fig. 9, the ring is of soft iron, and is separated from the spindle and supported by a casting, made of non-magnetisable material. The winding in this case is also longitudinal or parallel to the axis of the spindle, but instead of passing over the ends, each turn passes through the hole in the middle of the ring. The first or drum form of winding was invented by Hafner von Alteneach, and is commonly used. It has its advantages and disadvantages, but on the whole it is theoretically the most perfect form of winding. It is more generally used for the larger class of machines. The ring form, which is generally associated with the name of its inventor Gramme, is that generally used for smaller machines, or for machines of very high E.M.F. It also has its advantages and disadvantages, which I will hereafter refer to. The part played by the armature core is a twofold one. First it acts as an armature or continuation of the magnets themselves. If there was no core, the space between the poles of the magnets to admit of the winding would be so large that the magnetic field between the poles would be excessively weak, but by the introduction of the soft iron core, this space is reduced to the two small spaces which are partly taken up by the winding and partly by the clearance or air space necessary to allow the entire armature to revolve at a high speed without fear of the winding touching or coming into contact with the bored out surface of the cavity in the field-magnets.

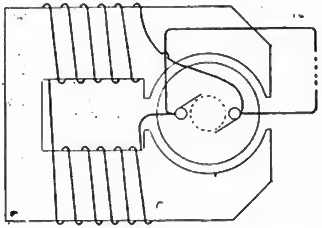


FIG. 7.

In addition to this the armature core plays the part of giving a firm mechanical support to the winding and of transmitting the horse-power from the spindle to the winding, and I may here remark that this is a very serious matter. To those who use dynamo machines and motors for the first time, it is a matter of astonishment where the horse-power goes to, they cannot understand why a large heavy belt, or if the machine is direct driven, a large steam engine is required to revolve the armature, when to all appearances there is nothing to oppose its revolution but the mere friction of the bearings. Until the current begins to be generated the magnetic field does not exist, and consequently the armature may be revolved freely without any apparent resistance to its motion, but so soon as the field-magnets become what is technically termed excited, that is to say that they become powerful magnets by the passing round them a part of the current produced by the machine, then the resistance to the motion of the armature is very real indeed, and the mechanical strain on all the parts supporting the winding is very great. It is in connection with the transmission of these strains, from the spindle to the winding, that many of the difficulties that so trouble builders of dynamo machines exist. A very large horse-power has to be transmitted from the spindle to the winding, but for electrical reasons we are debarred from the use of metals best suited to transmit the strains, and in no case can we use metal to metal, but nearly everywhere we have to interpose layers of insulating material of comparatively small mechanical strength between the various parts of the armature.

The diagrams are not correct representations of the armatures of machines as we make them in practice, as on the diagram it is not possible to show the large number of turns of winding required for machines used for electric lighting purposes. But they actually do resemble the winding of machines for purposes where very low E.M.F. is required, such as those for electro-plating; but to bring actual facts home to you I will describe shortly the general dimensions and mode of construction of a working dynamo machine intended to supply about 166-16 C.P. lamps, or 332-8 C.P. lamps, of 100 volts E.M.F., and with conductors that will carry 100 amperes without unduly heating. Taking the armature and working outwards, we have a steel spindle with journals at each end revolving in pedestals which may be of any approved construction. The armature core consists of a number of thin discs of excessively soft, well-annealed, pure wrought iron, generally Swedish iron, about 9 in. external diameter and with a 5½ in. hole punched through them. These discs are about No. 20 B.W.G. thick, and as the length of the armature is about 9 in. it requires about 180 of these discs to make up this length.* The discs are supported concentrically to the spindle by being forced on to three gun-metal frames or radial bars, which are held at their inner edges by three deep grooves or key ways cut on an enlargement of the spindle and which hold the discs in position at their outer edges by being milled into a dovetail corresponding to dovetail shaped notches punched in the discs. The discs are cramped up on the radial bars, the ends of the bars are riveted over, and the outsides of the discs are then carefully turned in a lathe, and the whole is balanced so as to revolve without vibration when run at the required speed in its bearings. After balancing, the mounted core is insulated by being carefully covered with one or more layers of mica alternated with strong linen tape soaked in copal varnish. A certain number of fixed projections or driving teeth for the purpose of preventing the winding which has now to be applied, from moving on the smooth surface of the armature, have now to be fixed in the core. One way of doing this is to drill the laminated core with the required number of rows of holes, and this can be readily done with a very sharp twist drill. The driving teeth which are T-shaped drop forgings made of Delta metal or aluminium bronze are driven into these holes and are afterwards covered with insulating material. The mounted and insulated core is now ready for the winding. In the machines I am describing this may consist of about 200 turns of insulated copper wire of nearly square section. The section is so calculated that when the wire is wound on in one layer on the external periphery and in two layers where it passes through the internal hole, the width is such that it exactly covers the surface of the core in the spaces left between the driving teeth. The successful working and freedom from breakdowns of dynamo machines greatly depends on the way in which this winding is carried out and on close attention to the abutting of the turns so that there is no movement or sliding action of the turns one on the other, all such movements tending to cause abrasion and certain destruction of the insulating material which separates the turns from one another and from the core. For this size of machine the insulating material most commonly employed is cotton wound on by suitable machines in two layers and afterwards coated with copal varnish and then thoroughly stoved. Cotton thus coated and stoved becomes excessively tough and not only stands considerable abrasion, but when this varnish is used it does not become carbonised or get brittle under the action of heat until a comparatively high temperature is reached, say 300 deg. Fah. The ends of the winding of this machine may be brought out at every other turn, or possibly at every third turn, they then are soldered into notches in what is called the commutator or collecting cylinder. The collecting cylinder is that part of the machine I above referred to as redressing or converting into a continuous current the alternating currents originally produced by the winding. Everyone who has seen a dynamo machine will readily recognise the collector as the copper polished cylinder seen at one end of the armature which appears to be divided off by a number of longitudinal black lines. This collecting cylinder is not a solid copper cylinder. The black lines are slips of mica which completely insulate from one another a number of copper segments which when held together form the complete cylinder. The segments are held in place by conical washers pressing against their two ends, corresponding washers made of mica or other insulating material being interposed between the ends of the segments of the washers. The mode of winding this armature and of the coupling of the wires to the commutator is that shown on diagram Fig. 9, but of course as there are in practice a very much larger number of turns of wire than number of sections in the commutator, it at first sight appears much more complicated than the winding shown on the diagram, but it is really not so. The winding of the armature is simply an unbroken helix extending completely round the core. The commutator segments may be considered as projecting parts of the winding, bared of their insulation, which are soldered on to a sufficient number of the turns, in fact the same effect would be produced if the machine had no commutator, the last end being joined to the starting end and afterwards part of the insulation being removed by filing or other means so as to bare the outsides of the wire at one part of the winding. This bared part would then act as a commutator, in fact would be a commutator, but it is readily seen that it would not have sufficient mechanical strength or wearing power for the purpose. The collecting of the currents from the commutator is by means of brushes or rubbers usually made of copper, either in the form

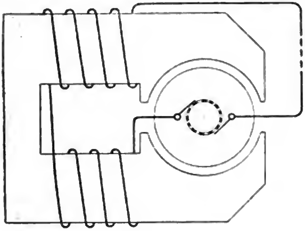


Fig. 7A.

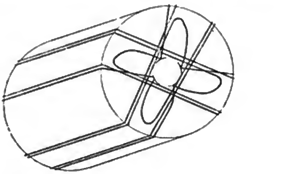


Fig. 8.

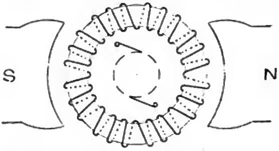


Fig. 9.

of a bundle of copper wire or of a number of thin plates of what is called stencil copper laid one on the other, the object being in both cases to ensure a soft and elastic contact even when the machine is running at high speeds. This point at which the brushes rub on the commutator is the only point (in addition to the bearings) at which a dynamo machine is liable to wear and require renewal. Unless carefully handled the commutator is likely from time to time to get out of truth and requires to be trued up in a lathe and considerable care must be taken in the right placing and adjustment of the pressure of the brushes. Nothing but practice can give this knowledge. One man will make his commutator and brushes last for years, whereas another man will require frequent new brushes, and the commutator turning every few months. The care of the surface of the commutator in very large machines is a very important matter, and has received much attention from us engineers, and I could quote many cases where machines have actually run three years with one pair of brushes, and have maintained the surface of the commutator polished like a mirror. I have dwelt at considerable length on this point because it is a practical one with which you are all likely to come in contact, and nothing is so annoying or so distressing to the eye as to see bad lighting on board ship, caused by want of attention to the commutators of the machines; in fact it is one of the very common causes which produces flickering or unsteadiness of the electric light.

The magnetic field in which the commutator I have described revolves consists in this case of a double horseshoe magnet, as shown in the diagram, Fig. 10, we find this form convenient for the purpose. The magnet consists of four rectangular bars of soft iron, arranged in pairs separated at the required interval, and the space in which the armature revolves is bored out of the solid in a large boring machine. The magnets themselves are excited or made into electro-magnets by a portion of the armature current passing round them through what is called the shunt coils. The word shunt, so often used by us electricians, is used to represent a conductor carrying a portion of the current diverted from the main conductor. It is usually a small current flowing in a channel of much higher resistance than that of the main conductor. In the case of this machine probably not more than 1-50th of the main current will flow through the shunt. I have now briefly described the main organs, viz., the armature and the field magnets of this machine which, as I have already said, is intended to produce an electric pressure or E.M.F. at its terminals of 100 volts. The amount of current which will flow through this machine will chiefly depend on the amount of external resistance through which the current has to pass. If this resistance be that of 166-16 C.P. lamps arranged in parallel circuit, then the current will be 100 amperes; if a smaller number are used the resistance will be increased, and from Ohm's law, already described to you, you will see that the current flowing will be proportionately diminished. You will now ask me what it is that determines the power and output of a machine of the size that I have described? There are two limiting causes. In the first place, if the resistance in the external circuit was reduced so greatly that the current was increased to three or four hundred amperes the driving power would then be found insufficient; the output of the machine in electrical energy would then be greater than it would be possible to communicate to the spindle by any reasonable arrangement of driving gear, whether in the shape of belts, rope-driving or direct-driving. In fact, the whole of the mechanical arrangements of the machine would be too small for their purpose; but in addition to this another hindering cause would come into operation, and that is that a portion of the electric circuit is within the machine itself. Now I must here go back a little and tell you what I have not told you before, that wherever electricity traverses a conductor, and hence meets with a resistance, that electrical energy is transformed into heat energy. The whole of the loss of E.M.F., or electrical pressure, which we find when a current traverses a conductor, is accounted for in the shape of heat energy, which raises the temperature of that conductor. In fact, when we are using electrical energy for electric lighting purposes, we utilise the energy solely in the form of heat produced in portions of the conductor, which being formed of filaments of carbon of excessively high resistance, are easily raised to an elevated temperature, at which the light rays are given off freely; but although the other portions of the circuit traversed by the electric current are not heated to the same extent, yet they are all heated more or less. As a rule we so arrange and design our conductors that the heating in the parts where the electricity is not to be utilised is kept as small as possible. We use for our conductors materials of the very highest conductivity, such as pure copper, and we make the sectional area as large as possible, but however much we enlarge the area there always will be some heating, and in the case of the machine I have been describing to you, the practical limit of the output of the machine is the amount of current that can be safely carried by the armature coils without heating them to an extent injurious to the insulation. This is a matter of the highest importance to you gentlemen who so often have to employ dynamo machines worked in engine-rooms where the temperature of the air is already excessively high. This high initial temperature reduces the output of your dynamos in two ways: first, by actually raising the initial temperature of the copper and consequently increasing its resistance, so that the heat units generated by the passage of the current are greater than they would have been if the copper were cold; and secondly, the initial temperature being so high there is a very small margin of temperature through which the coils can be raised before reaching 180 or 190 degs. Fahr., which I have already told you is the limit at which some kinds of insulation begin to become charred, and loses mechanical strength.

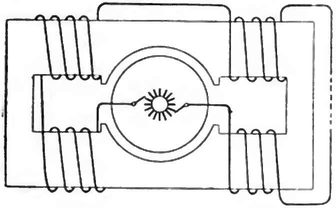


Fig. 10.

I have not said anything as yet on the efficiency of these dynamo machines. By efficiency I mean the output in electric H.P., or in watts, compared with the horse-power put into the belt, or other means of driving the spindle. You have no doubt heard that of late years we electrical engineers have been very successful in this respect; and that the dynamo machine is already a highly efficient machine. There are many firms who can make machines to give back at the terminals 94 per cent. of the mechanical energy put into the spindle; the whole of the small balance of 6 per cent. being changed into heat-energy, which is wasted in the coils or friction in the bearings or brushes. I had hoped in the limits of this lecture to complete my brief sketch of electric generating machinery by touching on the various modes of producing the H.P. required to revolve the spindle, but I find it will be necessary to withhold this for my second lecture.

AN IMPROVED SEA-ANCHOR AND OIL DISTRIBUTOR.

THE Merchant Shipping (Life Saving Apparatus) Act will come into operation on the 1st of November next. It provides that all sea-going ships, steam or otherwise, shall carry boats fitted with sea-anchors and vessels containing oil suitable for distributing it in the water in rough weather.

We give illustration of an improved sea-anchor and oil distributor invented by Mr. R. G. Lacey, of Summerley Street, Earlsfield, which has been specially designed to meet the requirements of this Act.

It consists, as will be seen from the illustrations, of stout canvas, A A, about 3 ft. square (for large boats) secured to a wooden spar B at the top, and weighted at the bottom by a galvanized iron rod sewn into the canvas at F F. At C, a pocket is formed in the canvas, close under the spar, containing a copper oil vessel large enough to hold about one-and-a-half gallons of oil, secured by a lacing at D. At G G, screw caps are provided (which cannot be lost), which, when unscrewed allow the oil to escape at a slow rate from the oil-vessel of the boat, thus calming the water some distance to windward. As the oil flows out it is replaced by water, which enters through a similar opening at H. I, at the end of the oil-vessel (see Fig. 3) is for filling again. E E are strong galvanized iron eyes for stretching the anchor upon the spar, and for suspending the apparatus beneath one of the boat's thwarts when not in use (see Fig 2). K K are toggles for gathering up the canvas portion with the bridles, &c., inside when stowed away as shown. In using the anchor, the boat-rope is taken through the thimble L in the upper bridle, and is fastened to M in the lower bridle. By attaching another smaller line to the thimble L the anchor can be tripped or spilled at any time, it being only necessary to haul upon the small line and slack out the boat-rope. The spar B is so proportioned that it floats the whole anchor, including the iron rod which acts as sinker, and the copper oil vessel filled with oil.

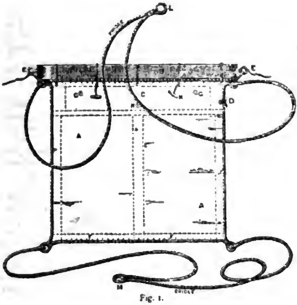


Fig. 1.

Fig. 3.

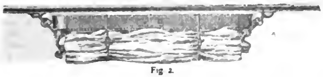


Fig 2.

The anchor and oil vessel can be used separately, but are better used in conjunction. The sea-anchor is so arranged that any other spars which may happen to be available can be quickly lashed to it, thus enabling it to act as a floating breakwater as well as anchor.

STEAM TRIALS OF H.M.S. "NILE."

THE *Nile*, battleship, laid down at Pembroke on April 8th, 1886, and launched on March 27th, 1888, concluded her contractors' steam trials at the back of the Isle of Wight last month. With her sister ship *Trafalgar*, the junior flagship on the Mediterranean Station, she was designed by Messrs. Barnes & Morgan, of the Admiralty Constructive Department, at a time when the popular outcry against the ships of the *Admiral* type had reached a crisis. As a result of the crusade the new ships were given longer and higher armoured protection at the water line, greater freeboard (combined with increased defence at the extremities against the fire of machine and quick-firing guns), and a turret mounting for their main armament, with consequent larger dimensions and displacement, and augmented engine power, but without any appreciable increase of speed The *Nile* measures 345 ft. in length and 73 ft. in beam, with a displacement of 12,000 tons. Her complement of four 67-ton guns has been received in the dockyard, but as the War Department had failed to send them in time to be mounted previous to the trial, their equivalent in weight in the shape of water was run into the double bottom in order to give the ship the necessary immersion to render the results of practical utility as a measure of her actual performance under sea-going conditions. Her estimated load draught was 27 ft. 6 in., and at the trials her mean draught was precisely the same—27 ft. forward and 28 ft. aft—without stores and crew. According to the official programme, the *Nile* is to be completed this month.

The propelling engines, by Messrs. Maudslay, Sons & Field, are contracted to develop 12,000 horses under forced draught, and 7,500 under natural draught, and are expected to indicate a mean of 4,750 on a continuous sea-going run of 96 hours, with open stokeholds. Under these conditions the ship is estimated to realise a speed of 17 knots, 16 knots, and 13·75 knots respectively. The amount of coal carried at the load draught is 900 tons, which, it is calculated, will give a radius of action of 4,900 knots at a speed of 10 knots. The engines consist of two sets of the triple-expansion type, with inverted cylinders. The high-pressure cylinder has a diameter of 43 in., while that of the intermediate cylinder is 62 in., and of the low-pressure cylinder 96 in., with a stroke of 51 in. Each cylinder is supported upon four cast-steel columns, the slipper guides for the cross-heads being bolted to cast-steel standards. The frames of the engines are also constructed of cast-steel; the high-pressure cylinders are fitted with piston valves, and the others with double-ported slide valves. The valves are worked by link motion and double eccentrics, the valve gear being so arranged that each cylinder can be linked up separately for working expansively. The surface condensers, which are made entirely of brass, contain 7,642 horizontal tubes of the same metal, 10 ft. long, with an external diameter of ¾ in , and giving a cooling surface of 15,000 square feet. A couple of inclined air pumps, actuated from the piston rod-heads of the intermediate and low-pressure cylinders, are provided to each set of engines. Steam is furnished by six single-ended cylindrical boilers, 10 ft. 3 in. long and 16 ft. in diameter. They are wholly made of Siemens-Martin steel, and contain in all 24 corrugated furnaces, 7 ft. 5 in. long, with a mean diameter of 3 ft. 4½ in., and affording a total area of grate surface amounting to 604 square feet. The boilers contain 3,564 steel tubes, 7 ft 5 in. long by 2¼ in. in diameter, giving a total tube surface of 17,040 square feet, and an aggregate of 19,380 square feet of heating surface. The ship is propelled by four-bladed screws, having a diameter of 16 ft. 6 in. and a mean pitch of 21 ft. 3 in., and which worked so well that the absence of vibration was one of the noticeable features of the trials.

The four-hours' run with open stokeholds was made with very satisfactory results. As previously stated, the specified I.H.P., with natural draught, is 7,500, but the result of the half-hourly observations gave a mean collective power of 9,074, the starboard and port engines developing 4,612 and 4,462 horses respectively. The *maximum* power indicated at any time was 10,112. Speed was not taken.

In the testing of powerful machinery more particularly, the run with open stokeholds is regarded as little more than a preliminary spin by way of preparation for the crucial trial with forced draught. The trial under this condition was made two days after the natural draught trial. Commander M'Gill was in charge of the ship, the Admiralty being represented by Mr. Butler, the Steam Reserve by Mr. Heffernan (Chief

Inspector of Machinery), and the Dockyard authorities by Mr. Mayston. Mr. R. Sennett (managing director) and Mr. Warriner superintended the trial on behalf of the contracting firm. The *Nile*, after considerable delay, caused by defective anchor gear, got under way from the anchorage about 11 o'clock, and at a quarter to 12, the engines having in the meantime attained the requisite number of revolutions, the first half-hourly observations were taken, and they were continued to the end without a break occurring. Everything contributed to the success of the trial. A light breeze blew from the south-west, and consequently on the beam; the sea was smooth, and both the stokers and the coal (Harris's deep navigation) were picked. The following is the tabulated results of the four hours:—

Boiler Pressure.	Revolutions.		Vacuum.		Indicated Horse-power.
	Starboard.	Port.	Starboard.	Port.	
128	94·33	93·63	29	26¼	11,994
133	94·80	93·46	29	26½	12,112
131½	93·36	92·46	26	26¼	12,013
134	93·60	92·80	26	26½	11,900
135	94·33	93·40	26	26½	12,362
134½	93·16	92·66	26	26½	12,087
132½	94·36	92·83	26	26½	12,096
134	94·40	93·80	26	26½	12,256

When worked out, the above *data* gave the following means:—Steam in boilers, 132·80 lbs.; vacuum, 26 and 26·4 ins.; revolutions, 94·04 and 98·13; I.H.P., 1,744 and 1,756 (high), 2,252 and 2,091 (intermediate), and 2,147 and 2,112 (low); starboard, 6,143; port, 5,959; giving a collective I.H.P. of 12,102, with an average air pressure in the stokeholds of 1·82 in. A couple of runs on the measured mile showed a mean speed of 16·88 knots, while subsequent distance measurements outside the Warner gave 17 knots. Steam continued to blow off throughout the trial, and, as will be seen from the returns, the uniformity of the steaming was remarkable. The falling off during the fourth half-hour was due to the turnings on the measured mile, and as soon as the *Nile* was taken out to sea the power at once rose. The engines were stopped and started in 14 seconds. Although the wind only blew with a force of from 3 to 4, and there was not sufficient sea to lift the ship, the forward deck was always awash, and when the ship was steaming down Channel clouds of spray broke over the turret.

THE SPONTANEOUS IGNITION OF COAL CARGOES.

By Professor Vivian B. Lewes, Associate F.C.S., F.I.C.

(Concluded from page 102.*)*

WE can now trace the actions which cumulate in ignition. The newly-won coal is brought to the mouth of the pit, and at once commences by virtue of its surface action to absorb oxygen from the air, but unless piled in unusually large heaps, and a good deal broken, it does not, as a rule, show signs of heating, as the exposed surface is comparatively small, and the air, finding its way freely between the lumps, keeps down the temperature. The coal is now screened, and the obtrusively large lumps of brasses picked out; it is then put in the trucks and enjoys the disintegrating processes of joltings and shuntings innumerable, every jar adding to the percentage of small coal present, and a corresponding increase in the size of the surface exposed to the air. Arrived at the docks it has to be transferred from the truck to the ship, which is done by one of the numerous forms of tips, shoots, or spouts employed for the purpose, and it is during this operation that more harm is done than at any other period. The coal first shot into the vessel by reason of the distance which it has to fall is broken down into small lumps, and having to bear the impact of the succeeding load falling upon it from a height, rapidly becomes powdered into slack, whilst the succeeding loads falling in on the cone so formed get more or less broken down, so that by the time the cargo is all taken in, a dense mass of small coal is to be found under the hatchway, and it is invariably at this point that heating takes place, as the large surface exposed fresh to the air by the breaking down of the coal causes rapid absorption of oxygen, and consequent rise of temperature. This sets up chemical combination between the oxygen absorbed by the coal and the hydro-carbons and coal brasses.

The combination of the brasses with oxygen causes the swelling of the oxidised mass and splitting up of the coal; fresh surfaces are exposed, and more absorption of oxygen takes place, and the igniting point of the sulphur vapour and sulphur compounds distilled out of the pyrites is reached, and rapidly raises the temperature to the ignition point of the coal. It is only in cases where large quantities of dense coal brasses are present that this action can take place, as in the ordinary case, where 1 or 2 per cent. only of pyrites are present, the sulphur vapour distilled out from the pyrites is oxidised to sulphur dioxide at temperatures far below the point of ignition of sulphur vapour; and in such cases the heat of absorption and oxidation of the bituminous portions of the coal is amply sufficient to raise the temperature to the requisite 752° to 932° Fahr. (400° to 500° C.).

On examining the evidence to be obtained as to the conditions under which spontaneous ignition of coal in ships usually takes place, it is found that liability to ignition increases with:—

(1) The increase in tonnage of cargoes.

Thus, in cargoes of under 500 tons the cases reported amount to a little under ¾ per cent. for shipments out of Europe; from 500 to 1,000 tons, to over 1 per cent.; from 1,000 to 1,500 tons, to 3·5 per cent.; 1,500 to 2,000 tons to 4·5 per cent.; and over 2,000 tons to no less than 9 per cent.

The evidence demonstrating this very remarkable result is to be found in the Report of the Royal Commission for 1875, p. viii., and clearly shows the influence of mass upon this action, which acts in two ways:—

(*a*) The larger the cargo, the more non-conducting material will there be between the spot at which heating is taking place and the cooling influence of the outer air.

(*b*) The larger the cargo the greater will be the breaking-down action of the impact of coal coming down the shoot upon the portions first loaded into the ship, and the larger therefore the fresh surface exposed to the action of the air.

(2) The ports to which shipments are made: 26,631 shipments to European ports in 1873 only resulting in 10 casualties, whilst 4,485 shipments to Asia, Africa, and America gave no less than 60.

This startling result is partly due to the length of time the cargo is in the vessel, the absorption and oxidation being a comparatively long action, but a far more active cause is the increase in the action brought about by the increase of temperature in the tropics, which converts a slow action into a rapid one, and if statistics had been taken, most of the ships would have been found to have developed active combustion somewhere about the neighbourhood of the Cape, the active action developed in the tropics having raised the temperature to the igniting point of the coal by that time.

(3) The kind of coal of which the cargo consists, some coals being specially liable to spontaneous heating and ignition.

This is a point on which great diversity of opinion exists, but I think it will be pretty generally admitted that cases of heating and ignition are more frequent in coals shipped from East Coast ports than in shipments of the South Wales coals. As has been pointed out, however, so much depends on the amount of small coal present that a well-loaded cargo of any coal would be safer than a cargo of Welsh steam coal in which a quantity of dust had been produced during loading.

The idea that the percentage of pyrites present is any indication of the liability to spontaneous combustion must be entirely discarded, as experiment shows that many coals poor in pyrites frequently ignite, whilst others rich in them are perfectly safe.

A much surer guide is to be found in the quantity of moisture present in an air-dried sample of coal, which is a sure index to the absorptive power, the higher the amount of moisture held by the coal after exposure for some time to dry air, the greater will be its power of absorption for oxygen, and the greater therefore its liability to spontaneous heating and ignition.

This is beautifully shown by the table on opposite page, in which the percentage of pyrites and moisture present in some coals are contrasted with their liability to self-ignition.

(4) The size of the coal, small coal being much more liable to spontaneous ignition than large.

This, as has been pointed out, being entirely due to the increase in active absorbent surface exposed to the air, a fact which is verified by the experience of large consumers of coal on land; gas managers recognising the fact that coal which has been stamped down or shaken down during storage being more liable to heat than if it has been more tenderly handled, the extra breakage causing the extra risk.

(5) Shipping coals rich in pyrites whilst wet.

Liability to Spontaneous Ignition.	Pyrites per cent.	Moisture per cent.
Very slight	1·13	2·54
	1·01 to 3·04	2·75
	1·51	3·90
Medium	1·20	4·50
	1·08	4·55
	1·15	4·75
Great	1·12	4·85
	0·83	5·30
	0·84	5·52
	1·00	9·01

The effect of external wetting on coal is to retard at first the absorption of oxygen and so to check the action, but it also increases the rate of oxidation of the pyrites, and so causes disintegration of the coal, with consequent crumbling and heating due to exposure of fresh dry surfaces.

(6) Ventilation of the cargo.

The so-called ventilation, which has from time to time been introduced into coal ships, is undoubtedly one of the most prolific causes of spontaneous ignition.

For ventilation to do any good, cool air would have to sweep continuously and freely through every part of the cargo, a condition impossible to attain, whilst anything short of that only increases the danger, the ordinary methods of ventilation supplying just about the right amount of air to create the maximum amount of heating. The reason of this is clear. A steam coal absorbs about twice its own volume of oxygen, and takes about ten days to do it under favourable conditions, and it is this oxygen which in the next phase of the action enters into chemical combination and causes the serious heating.

A ton of steam coal occupies 42 to 43 cubic feet, and if properly loaded contains between the lumps as nearly as possible 12 cubic feet of air space, that is to say, of the 42 cubic feet 12 cubic feet is air and 30 cubic feet is coal.

Thirty cubic feet of coal, with its fresh absorbing surfaces laid bare by the crushing incidental to loading, will, in the first ten days after being taken on board, absorb 60 cubic feet of oxygen, if it can get it. Now, air contains only, roughly, one-fifth of its volume of oxygen, so that 60 cubic feet represent 300 cubic feet of air, or twenty-five times as much as is present; so that it is evident that if air could be excluded there would be only one-twenty-fifth the quantity of oxygen present which is needed for complete action, and any heating would, in consequence, be very slight; whilst to produce the greatest heating it would be necessary to change the entire air in the cargo twenty-five times in the first ten days, and this is just about what the ordinary method of taking a box shaft along the keelson with Venetian lattice upshafts from it would give.

The most forcible illustration of the evil of such ventilation is to be found in the case of the four colliers, *Euxine*, *Oliver Cromwell*, *Calcutta*, and *Corah*, which were loaded at Newcastle under the same tips, at the same time, with the same coal, from the same seam. The first three were bound for Aden, and were all ventilated. The *Corah* was bound for Bombay, and was not ventilated. The three thoroughly ventilated ships were totally lost from spontaneous ignition of their cargo, whilst the *Corah* reached Bombay in perfect safety.

(7) Rise in temperature in steam colliers due to the introduction of triple-expansion engines and high-pressure boilers.

It has been fully pointed out that anything which tends to increase of initial temperature increases the rapidity of chemical action. Steam at 80 lbs. boiler pressure has a temperature of 324° F. (162 C.), and a common stokehold temperature with boilers worked at this pressure is 100° to 130° F. (or 38° to 54° C.). Steam at a boiler pressure of 155 lbs. has a temperature of 368° F. or 186° C., and gives a corresponding increase of temperature in the stokehold and other adjacent portions of the vessel, the temperature in the stokehold under these conditions being from 110° F. (43·5° C.) to 140° F. (60°), an increase of about 10° F.

It is, however, difficult in the Mercantile Marine to get a comparison of the increase in temperature due to this cause, but in the Service, some of the troopships have been from time to time refitted, and in the case of the *Malabar* and *Crocodile*, the temperature existing with the old simple low-pressure engines, the old compound engines, and the new triple-expansion engines can be contrasted, and will be found in the accompanying table, for which I am indebted to Mr. White.

TEMPERATURE RECORDS. H.M.S. "MALABAR" AND "CROCODILE."

	Locality.	Date.	Deck.	Coal Bunkers.	Engine Room.	Stoke-hold.
"CROCODILE," Original simple low pressure engines.		1874				
	Channel and Bay	Jan. 15	52	72	98	90
		,, 18	58	80	99	92
	Mediterranean	,, 23	65	86	98	92
		,, 27	66	84	100	92
	Red Sea	Feb. 6	68	92	108	106
		,, 10	81	100*	114	110
		1875				
	Channel and Bay	Feb. 11	46	66	90	105
		,, 12	54	70	94	102
	Mediterranean	,, 19	53	74	92	89
		,, 26	66	74	98	104
	Red Sea	Mar. 4	77	90	104	115
		,, 6	82	94	98	120
	Indian Ocean	,, 12	79	98*	104	114

	Locality.	Date.	Deck.	Coal Bunkers.	Engine Room.	Stoke-hold.
"MALABAR," Old compound engines.		1885				
	Channel and Bay	Oct. 3	59	85	82	89
		,, 6	63	86	86	110
	Mediterranean	,, 8	72	90	98	91
		,, 9	73	90	96	100
		,, 10	70	90	90	110
	Red Sea	,, 19	81	92	95	107
		,, 20	84	100	96	108
		,, 21	88	104*	104	119
		,, 23	87	102	97	112
"CROCODILE," Compound engines.		1888				
	Channel and Bay	Dec. 4	55	78	78	90
		,, 6	54	85	80	84
		,, 8	60	92	82	88
	Mediterranean	,, 12	64	97	80	100
		,, 15	60	95	78	90
		,, 17	62	112	83	94
	Red Sea	,, 22	74	113	92	100
		,, 23	80	115	96	103
		,, 24	82	116*	98	110
	Indian Ocean	,, 31	78	99	97	118

	Locality.	Date.	Deck.	Coal Bunkers.	Engine Room.	Stoke-hold.
"MALABAR," New triple engines.		1888				
	Channel and Bay	Dec. 13	49	77	78	72
		,, 14	56	86	86	88
		,, 16	62	80	84	90
	Mediterranean	,, 18	63	88	90	94
		,, 19	62	88	90	94
		,, 22	68	87	90	100
		,, 23	74	89	90	98
	Red Sea	,, 28	79	96	102	110
		,, 29	82	100	100	110
		,, 30	84	105*	100	108
		,, 31	83	104	104	110
		1889				
	Channel and Bay	Oct. 5	65	84	86	94
		,, 7	67	84	90	102
	Mediterranean	,, 10	76	100	92	102
		,, 11	80	100	93	99
		,, 15	79	104	96	100
		,, 16	80	106	96	106
	Red Sea	,, 19	83	106	103	102
		,, 20	86	110	102	110
		,, 21	89	115	108	108
		,, 22	92	120*	112	122

* Maximum temperature during voyages from Portsmouth to Bombay.

NOTE.—The Registers of the original engines of *Malabar* are destroyed; temperature records of *Crocodile* are given in lieu for a period when she was fitted with old low-pressure engines.

From this it will be seen that, taking the voyage through, the average increase of temperature in the stokehold from the use of the triple-expansion engines is about 5 degrees. This table is of great interest, as the temperatures taken during the outward voyage of the *Crocodile*, December, 1883, point to the coals in the bunkers commencing to heat, and also illustrate where and at what temperature it commenced.

Crossing the bay, the stokehold and bunker temperatures agree fairly well, but entering the Mediterranean, the stokehold having become heated to 100° F. on the 12th, action commenced in the bunkers, and this rapidly raised their temperature higher than that of the stokehold, the action, however, not being violent, and the bunker temperature rapidly falling below that of the stokehold as the chemical action died away.

Having now discussed the chemical and physical conditions which lead to the phenomenon known as "spontaneous ignition," we can formulate precautions which will tend to prevent such disasters.

(1) The Choice of Coal for Shipment to Distant Ports.

The coal should be as large as possible, free from dust, and with as little "smalls" as can be helped.

It is better as free from pyrites as possible, in order to prevent disintegration after shipment, *and it should contain when air-dried not more than 3 per cent of moisture.*

(2) Precautions to be Taken during Shipment.

No coal should be shipped to distant ports until at least a month has elapsed since it was brought to the surface at the pit's mouth. Every precaution should be taken to prevent breaking up of the coal whilst being taken on board, and on no account must any accumulation of fine coal be allowed under the hatchways.

When possible the coal should be shipped dry, as external wet, by producing oxidation of the pyrites, causes disintegration.

(3) Precautions to be taken on board Coal-laden Ships.

This phase of the question is undoubtedly the most important, and in order to ensure any successful treatment of the coal cargo at sea to prevent undue heating and ignition, the means adopted must be as nearly automatic in their working as possible, as it is useless to expect the master or any officer on board a collier during rough weather, &c., to comply with any instructions, such as daily taking the temperatures in various parts of the cargo, and so on.

The coal compartments should be made gas tight, as far as the bulkheads separating them from the rest of the ship is concerned; and as no difficulty is found in doing this when provision for forced draught is being made, no difficulty should be found in this case.

When the coal has all been taken in, it should be battened down, and the hatches should not be again opened until the vessel reaches her destination, the only ventilation allowable being a 2-inch pipe just inserted into the crown of each coal compartment, and led 12 ft. up the nearest mast, the top being left open. This would be quite sufficient to allow free egress to any gases evolved by the coals, but would not allow undue access of air.

Into the body of the coal cargo itself would be screwed, at regular intervals of about 6 ft., iron pipes, closed at the bottom, and containing alarm thermometers, constructed in the following way:—A long bulb of glass, containing mercury, has an insulated wire inserted into the quicksilver, and making contact with it, whilst the stem attached to the bulb has a second wire in it, so arranged that when a rise of temperature causes expansion of the mercury, in rising in the tube it makes contact, and the wires from these tubes are in connection with an electric bell, index board, and battery in the captain's room, so that the moment the temperature is reached to which the thermometers have been set, the bell rings, and will continue to ring until the temperature again sinks, the spot in which heating is taking place being indicated by the index board.

In the evidence given before the Commissioners in 1875, Mr. J. Glover strongly advocated the use of carbon dioxide, or carbonic acid gas as it is more usually termed, for extinguishing ignition when it had broken out in a coal cargo, and for stopping heating when it had reached a dangerous pitch. His proposal was to generate the gas by the action of hydrochloric acid upon chalk, and to lead it by gas pipes to the compartment effected, and this gas, being heavier than air and a non-sup[illegible]r of combustion, was to displace the air and its contained [illegible] and so to prevent further action by surrounding the coal with an atmosphere which could not carry on combustion. The idea was a good one, but there were many difficulties in the way of carrying it out, one being that for every thousand tons of coal carried, 80 cwt. of hydrochloric acid would have had to be shipped, also the gas could not have been driven down into the hold if any serious heating had taken place, as an up current would have been formed and would have carried it away, whilst in this state of gas it fails to give any great cooling effect, and so would have exercised but little influence upon the mass of red hot fuel. These objections weighed so strongly with the Commissioners that in their final report we find the following sentences:—

"Several methods for generating carbonic acid gas and applying it to the ignited portion of a coal cargo have been proposed for our consideration. We consider, however, that although this gas might be useful by excluding atmospheric air (which is essential to support combustion), yet it will not, as water does, exert any very sensible cooling effect, *which is a point of vital importance in the case of a mass of ignited coal.* We are of opinion that water and steam are the only agents practically available for the purpose of extinguishing fire in coal cargoes."

Applied in the way which was suggested, there is is no doubt but that the carbonic acid gas would have been practically useless; but there is another way in which it could be used, which would make it a most powerful cooling agent, and instantaneous quencher of fire, and would prevent any further tendency to heat on the part of the coal treated with it.

If carbonic acid gas is compressed under a pressure of 36 atmospheres at a temperature of 32° F. (0° C.), it is condensed to the liquid state, and can be obtained in steel vessels, closed with screw-valves. On opening the valve some of the liquid is ejected into the air, and on coming into the ordinary atmospheric pressure, is in a moment converted into a large volume of gas. Conversion from the liquid to the gaseous state means the absorption of a large amount of heat, and so great is this that everything near the stream of new-born gas is cooled down, and some of the escaping liquid is frozen to a solid, having a temperature of — 78° C., or — 108·4 F.

This liquid carbonic acid gas is now extensively manufactured, and is used abroad to a large extent for aërating waters, driving torpedoes, and for freezing machines; and I should suggest its use in the following way for the checking of ignition in the coal cargo:—

The nozzle attached to the screw-valve on the bottle of condensed gas would have a short metal nose-piece screwed on to it, the tube in which would be cast in solid, with an alloy of tin, lead, bismuth, and cadmium, which can be so made as to melt at exactly 200° F. (93° C.). The valve would then be opened, and the steel bottle buried in the coal during the process of loading. The temperature at which the fusible metal plug will melt is well above the temperature which could be reached by any legitimate cause, and would mean that active heating was going on in the coal; and under these conditions the pressure in the steel cylinder would have reached something like 700 lbs., and the moment the plug melted the whole contents of the bottle would be blown out of it into the surrounding coal, producing a large zone of intense cold, and cooling the whole of the surrounding mass to a comparatively low temperature. The action, moreover, would not stop here, as the cold, heavy gas would remain for some time in contact with the coal, diffusion taking place but slowly through the small exit pipe.

When coal has absorbed as much oxygen as it can, it still retains the power of absorbing a considerable volume of carbonic acid gas; and when coal has heated, and then been rapidly quenched, the amount of gas so absorbed is very large indeed, and the inert gas so taken up remains in the power of the coal, and prevents any further tendency to heating; indeed, a coal which has once heated, if only to a slight degree, and has then cooled down, is perfectly harmless, and will not heat a second time. It is not by any means necessary to replace the whole of the air in the interstices of the coal with the gas, as a long series of experiments show that 60 per cent. of carbonic acid gas prevents the ignition of the most pyrophoric substances.

One hundred cubic feet of gas can be condensed in the liquid state in a steel cylinder 1 ft. long and 3 in. diameter, and it has been shown that a ton of coal contains air spaces equal to about 12 cubic ft.; therefore, one of these cylinders would have to be put in for every 8 tons of coal, and these would be distributed evenly throughout the cargo, and near the alarm thermometers, which would be set to ring a degree or two below the point at which the fusible plug would melt.

The bell ringing in the captain's room would warn him that heating was taking place, and the bell would continue to ring until the cylinder had discharged its contents, and had cooled down to a safe degree, so that the whole arrangement would be purely automatic, and yet the officers would know if everything was safe.

This liquid is now being made at a comparatively cheap rate and with any demand for it machinery could be put up at the principal coaling ports to charge empty cylinders at a very low rate, so that the initial cost of the steel cylinders once got over the expenses would not be worth considering, more especially as one, or two at most, would be likely to go off.

If the precautions advocated were taken, no danger could arise until the arrival of the ship at her destination, and the commonest precautions would then suffice. On removing the hatches, no naked light must be allowed near them, and no one must be allowed to descend into the hold until all the gases have had time to diffuse out into air. If the cylinders have gone off there will be but little fear of explosion, as a high percentage of the carbonic acid gas lowers the explosive power which the mixture of marsh gas (given off from some coals) and the air possess; but the carbonic acid gas would overcome and suffocate a man descending into an atmosphere containing any considerable percentage of it. When a safety lamp lowered into the hold continues to burn as brightly as it did in the open air, then it is perfectly safe to descend.

When once coal in a cargo has fired, pumping in water is of practically no use, as the fire is, as a rule, near the bottom of the mass of coal, and the flow of the water is so impeded, that in percolating through the interstices of the heated coal, it is converted into steam before it can reach the seat of combustion. The most effective way to apply water would be to have four 3-in. pipes laid along the floor of the coal compartments, about 6 ft. apart, these tubes having ½-in. hole bored in the upper side every foot or so, and each pair of pipes coming through the bulk-head, and connecting on to two 6-inch pipes passing through the side of the vessel, the sea water being prevented from entering by means of screw-valves. As soon as the alarm thermometer gave notice that heating had reached a dangerous point, these valves could be opened and the lower portion of the cargo drenched with salt water. This, evaporating rapidly would give large volumes of water vapour, which, passing up through the heated coal, would lower its temperature, but would not be nearly as effective as the method before advocated. It might, however, be used in conjunction with that method, and would, in many cases, save the carbonic acid gas.

The question of preventing the heating and ignition of stores of coal on land and ready for use in bunkers, cannot be met so well by the use of the liquid gas, and, in these cases, it would be found beneficial to dress the coal with a little tar or tar oil, which would close the pores, and to a great extent prevent oxidation. I believe this was advocated by Lachman about 1870.

Crude petroleum in small quantities for this purpose would also be found valuable, for, as already shown, it has no tendency to oxidise itself, and lowers the tendency in other bodies, besides coating them, and so preventing access of oxygen.

The labour trouble in the coal trade is hampering all branches of industry, and, with increasing difficulty in obtaining coal, all sorts of rubbish will be shipped, and many a cargo of coal will go out during the next few months which, under normal conditions, would never have been allowed on board; and we may expect a heavy increase in the loss of life and property from spontaneous ignition. This will probably result in a rise in the rate of premium, and further check to our export coal trade; and I sincerely trust that, should these gloomy forebodings be fulfilled, the suggestione made in this paper, and based on experimental facts, may be found of value.

In conclusion, I wish to acknowledge my indebtedness to the researches of Dr. Richters, whose papers on the weathering of coal are to be found in Dingler's *Polytechnisches Journal* for 1870; to the report of the Royal Commissioners on this question in 1876; and, finally, to Mr. Martell for suggesting the subject of this paper.

A Powerful Fan.—Mr. F. D. Bumpstead has just supplied a very large fan to Messrs. Palmer's Shipbuilding Co. for s.s. *Irene* (for Trinity Board). Diameter of fan, 90 ins.; to deliver 42,000 cubic feet of air per minute to the stokehold. This is about the largest and most powerful fan on any steamship.

"VENTILATION."

A MEETING of the Institute of Marine Engineers was held on Tuesday, 27th May, presided over by Mr. G. W. Manuel, when Mr. D. G. Hoey read an exceedingly interesting paper on "Ventilation," preliminary to which he said that in order to convey a clear understanding of the method by which all "inhabited interiors," including cabins, berths, engine-rooms, stokeholds, &c., of steamships, as well as the compartments of railway carriages, may be thoroughly ventilated, wholly free from currents or draughts, it is needful to state, at the outset, the principles by which such effective ventilation is regulated and controlled, which are universally operative.

The world is enveloped in a fluid, to which we give the name of air or atmosphere, permeating and filling every crevice, excepting only such as are filled by that other, denser fluid, to which we give the name of water. Man chooses for his habitation a niche not filled with water, and therefore permeated throughout by air, of which it contains, always, its full measure, neither more or less, and which can neither be increased nor diminished, except to the extent to which it may be expanded or contracted by differing degrees of temperature, or to which its total ponderosity may be effected by the presence, under special conditions, of a greater or less proportion of the more ponderous of the gases of which it is composed, as, for instance, in a highly corrupted atmosphere, containing an abnormal proportion of carbonic acid gas; but long before this element could be present in quantity sufficient to have any appreciable effect on the total density of the air or atmosphere, the occupants of the interior would be in a state of suspended animation, if not actually dead, by being starved for want of the oxygen, which had been used up, or asphyxiated by the carbonic acid gas produced in the using of it.

The quantity of air within every interior may thus, for all practical purposes be regarded as fixed and invariable, subject to the slight modifications already referred to, and to the also slight changes in the regulating power exercised by the weight of the whole superincumbent mass of the atmosphere, a weight sufficiently regular and clearly defined to be the recognised unit in mechanical science of all pressures, great or small, and designated "one atmosphere."

The paper then went on to deal with the fundamental principles which underlie a true and perfect system of ventilation, and after dealing with a compiled series of statistics, bearing upon the want of ventilation in the dwelling-houses of the poorest in the poorer districts of city life, Mr. Hoey went on to say that such atmospheric pollution is easily preventable, and that all this resulting excess of human misery and suffering may be brought to a speedy end, are propositions the demonstration of which will be found simple and conclusive, by giving thoughtful attention and consideration to the natural laws to which the atmosphere is obedient, and if, in stating these, he was found once more guilty of uttering truisms, this defence was that they are valuable truths, which, instead of being left to moulder in neglect, should be brought out of their obscurity and set polished and bright before the eyes of all men, that they may remedy the evil and effect the good for which they are adapted.

The laws which govern the denser fluid, water, and the rarer fluid, air, differ in respect of their density and rarity, but coincide in respect of their fluidity, and one law to which all fluids are subject, whether that filling the room in which we are now assembled, or that in the bed of the ocean or in the tiniest teacup, is that the part of the fluid which is rarest and lightest is found at the top, that which is densest and heaviest at the bottom, and where, from any cause, the operation of this law is disturbed, whether by rarer and lighter fluids being produced or admitted at the bottom or heavier or denser fluid at the top, this irregularity will at once correct itself by the lighter fluid rising or the heavier fluid falling to its proper level.

In proceeding to apply this law to the ventilation of human habitations, we may dismiss with a mere passing allusion the transcendent question of the rarefaction produced in the atmosphere of the higher heavens, by the gradual lessening of pressure, as the superincumbent mass of the atmosphere, from the blue cerulean to the earth's surface, becomes reduced in amount, and restrict ourselves to the manner in which the law acts at the level at which we dwell, and more especially its action on the atmosphere of our dwellings, whether on land or sea. It will thus be made clear to everyone that the facilities placed within our reach, almost thrust upon us by the unintermittent operation of this most beneficent law, for securing the continuous, thorough, healthful, and invigorating renewal of the atmosphere, leaving nothing to be desired, whilst the neglect heretofore bestowed on them is another instance of the indolent indifference to the "universally admitted true," which not only deprives us wholly of its life-giving power and energy, but, as has been shown, substitutes therefore suffering, disease and death. In concluding, Mr. Hoey pointed out that the two chief essential points in the needful arrangements for the admission of the fresh outer air, are (1) that it must be admitted at a low level, where it will mingle with the purest and coolest air already in the room, and yield its oxygen uncontaminated, for the respiration of the occupants; (2) that it must be admitted wholly free from infringing currents or draughts.

These two essentials are very simply and effectively attained, for preventing the immediate direct entrance of the air, from the outside into the room, and causing it first to fill a receiver or reservoir, and whether it may be introduced into the reservoir by a direct communication from the outside at that level, or brought down to that point by ducts from a higher level as may be most suitable or convenient in differing circumstances, it is at its entrance to the reservoir, baffled and sent in, in a lateral direction, by which means it loses its initial velocity of entrance, spreads itself slowly over the interior of the reservoir, gently percolates through innumerable interstices in a grating, wire gauze or other perforated fitting on the top, which is about 3 ft. from the floor and insensibly permeates the atmosphere of the room, by imperceptible diffusion, at the low level at which it immediately yields an abundant supply of oxygen to be breathed by the inmates. It is absolutely free from the current heretofore found to set in, from the point of entrance of air to the point of exit of air, which has been so invariable as to have come to be erroneously designated an "atmospheric law."

The air admitted in the heats of summer may be cooled by means of a frigorific mixture, inexpensive as to cost and vastly more powerful than ice in its action, contained in a vessel which is placed, when desired, in a space provided in the inlets or ducts, by which means the entering air passes over, beneath and around the refrigerator before entering the reservoir.

The extent of cooling can thus be regulated with ease and precision, according to the varying conditions of the outer atmosphere.

In winter the entering air may be warmed by a heating surface of pipes fitted in the reservoir. This heating process is under equally easy and simple control.

The discussion which followed the paper was of a very lively character, and was entered into with much relish by those present, Messrs. G. W. Manuel, J. McF. Gray, W. W. Wilson, R. Bruce, Captain Blackmore, Captain Froude, and others taking part.

A vote of thanks was proposed to Mr. Hoey by Mr. Gray, and seconded by Mr. Birkett, for the agreeable evening of which the reading of his paper had been productive. Mr. Hoey suitably replied, and the proceedings closed with a vote of thanks to Mr. Manuel, moved and seconded by Mr. D. Greer and Mr. A. Robertson respectively.

(*Unavoidably crowded out of last number.*)

PROPOSED NAVAL EXHIBITION.

It has been suggested in many influential quarters that advantage should be taken to utilize the buildings erected at Chelsea Hospital grounds for the military exhibition for the purpose of holding a similar undertaking next year in connection with the naval service. A preliminary conference was held on July 22nd at the Admiralty under the presidency of Lord George Hamilton to consider the matter, to which were invited the following:—Admiral of the Fleet the Hon. Sir Henry Keppel, G.C.B., Admiral of the Fleet Sir Alexander Milne, G.C.B., Admiral of the Fleet Sir Geoffrey T. P. Hornby, G.C.B., Admiral of the Fleet the Right Hon. Lord John Hay, G.C.B., Admiral Sir George Wellesley, G.C.B., Admiral Sir E. A. Inglefield, K.C.B., F.R.S., Admiral the Right Hon. Lord Alcester, G.C.B., Admiral Sir Augustus Phillimore, K.C.B., Admiral Sir George Willes, K.C.B., Admiral Henry Boys, Admiral Sir Arthur Hood, G.C.B., Admiral Sir William M. Dowell, K.C.B., Admiral Sir Edmund Commerell, V.C., G.C.B., Admiral the Right Hon. Earl of Clanwilliam, K.C.B., K.C.M.G., Admiral his Serene Highness Prince Victor Hohenlohe, G.C.B., Admiral Sir Algernon Lyons, K.C.B., Vice-Admiral Sir William Graham, K.C.B., Vice-Admiral Sir George Tryon, K.C.B., Rear-Admiral R. Mayne, C.B., M.P., Rear-Admiral Field, M.P. The Board of Admiralty.—Admiral Sir R. Vesey Hamilton, K.C.B., Rear-Admiral H. Fairfax, C.B., Rear-Admiral J. O. Hopkins, Captain F. G. D. Bedford, C.B., A.D.C., Mr. E. Ashmead-Bartlett, M.P., Mr. A. B. Forwood, M.P., Mr. Evan MacGregor, C.B. General Howard S. Jones (Deputy Adjutant-General Royal Marines), Dr. Dick, C.B. (Medical Director-General of the Navy), the Right Hon. Earl of Northbrook, G.C.S.I., the Right Hon. Lord Brassey, K.C.B., the Right Hon. Earl of Camperdown, the Most Hon. Marquis of Ripon, K.G., the Right Hon. H. Campbell-Bannerman, M.P., Captain J. A. Fisher, C.B., A.D.C., Captain Wharton, F.R.S., and Captain A. Jephson, most of whom were present.

The feeling of the conference was very warmly expressed in favour of the scheme, it being considered that the Navy could bring together a display of objects of great historic interest, as well as articles and models illustrative of the development of modern times, that would form a most attractive feature to visitors.

A provisional committee was appointed, consisting of Admiral Sir Edward Inglefield, K.C.B., F.R.S., Admiral Sir Augustus Phillimore, K.C.B., Admiral Boys, Lieutenant-General Howard Jones, Rear-Admiral Mayne, C.B., M.P., Rear-Admiral Colomb, Captain Fisher, C.B., A.D.C., Captain Bedford, C.B., A.D.C., Mr. A. B. Forwood, M.P., Mr. Ashmead-Bartlett, M.P., with power to add to their number, to visit the site of the proposed exhibition, with a view to report to a later meeting, when steps will be taken for the formation of the permanent general and executive committees to organize the undertaking.

A guarantee fund, towards which considerable promises of support have already been given, will be required, and from the popularity of the Service, and the desire always evinced by the public to assist naval objects, there is no doubt it will be soon completed. Such a guarantee will, it is hoped, be more nominal than real, as it is quite expected the forthcoming Royal Naval Exhibition will result in a handsome surplus, which is to be devoted to naval charities.

The scheme has the advantage of the patronage and support of his Royal Highness the Prince of Wales, as well as that of his Royal Highness the Duke of Edinburgh. Pending the appointment of the permanent committee communications may be addressed the Chairman, Provisional Committee, Royal Naval Exhibition, at the Admiralty.

LAUNCH OF H.M.S. "BLENHEIM."

This magnificent first-class protected cruiser, the latest addition to her Majesty's fleet, was launched from the yard of the Thames Ironworks and Shipbuilding Co., at Blackwall, on Saturday, July 5th, amidst a scene of the greatest enthusiasm.

The Victoria Steamboat Co.'s *H. M. Stanley* was specially chartered by the directors of the shipbuilding company to convey the invited guests to witness the launch, and she left the Speaker's stairs about one o'clock in the afternoon, and notwithstanding the inclement weather which prevailed a large number of persons elected to reach the scene of action by her aid. Among those on board were the Earl of Ravensworth; Admiral Hopkins and Mrs. Hopkins, who was to christen the vessel; Mr. Ashmead-Bartlett, M.P.; Mr. W. H. White (Assistant Controller and Director of Naval Construction), who is responsible for the design of the *Blenheim*; Mr. Arnold Hills, the managing director of the Co.; Master George Pollock; Mr. H. Lafone, of Butler's Wharf, and a considerable number of ladies. Many persons, however, elected to go to Blackwall by rail.

When the dockyard of the Thames Co. was reached, the huge hull of the new vessel was the centre of interest to all, and there was an all too short three-quarters of an hour to examine this noble specimen of new warship before the christening ceremony began.

The *Blenheim* is 375 ft. long between perpendiculars, 65 ft. broad amidships, 38 ft. deep, her draught is 25 ft. 6 in., and her displacement 9,000 tons. In many respects she resembles the *Warrior*, the first seagoing armour-clad vessel ever built, which, thirty years ago, was launched from the same company's yard. The *Warrior* had the same draught, but she was 5 ft. longer, 7 ft. narrower, and her displacement was 8,827 tons, and it is claimed for the *Blenheim* that the extra width given to her, although it would have been unsuitable to the *Warrior*, which was built for sailing as well as steaming, has enabled her designers to give finer lines to the ends of the new vessel. These are fine indeed, and were universally admired, and it is expected that she will have an unparalleled speed for a warship. She is sister to the *Blake*, now building at Chatham, and the pair will be the largest and most heavily-armed vessels of their type afloat.

The armour of the *Blenheim* is principally concentrated in her protective deck, and will weigh about 1,190 tons. Her hull is constructed on the cellular system, commonly adopted in her Majesty's ships, and although there is no novelty of principle in the structural arrangements, these have been most carefully worked out. From stem to stern the lower part of the hull is roofed over by a curved steel deck, supported by deep girder beams. The edges of this deck amidships are 6½ ft. below water, and the top rises 1½ ft. above water. On the slopes, over machinery and boilers, the protective steel is 6 in. thick, on the horizontal portion it is 3 in. thick. Below the protection of this deck are placed the propelling machinery, steering gear, magazine, shell-room, and all that is commonly styled the vitals of a warship. The *Blenheim* has no vertical armour on her sides, in which respect she resembles most of the cruisers recently built. Her armament will consist of two 24-ton guns, carried on the upper deck as bow and stern chasers with large horizontal arcs of command, ten 5-ton guns, intended ultimately to be quick-firers, of which the weight, with ammunition, would be equivalent to 20 6-in. service guns of the pattern now afloat, sixteen 3-pounders, and seven five-barrelled Nordenfeldt guns. Six of the 6-inch guns are to be carried on the upper deck, two being capable of firing right ahead as well as on the broadside, two firing right astern as well as on the broadside, and the midship pair training from 60 degrees before tó 60 degrees abaft the beam. Four of the 6-inch guns are to be carried on the main deck in casements composed of 6-inch steel-faced armour, two on each broadside. In addition to the guns the *Blenheim* will carry a powerful torpedo armament, including above water and submerged tubes, and her bow will be strengthened for ramming. She is to be propelled by twin-screws, driven by four sets of triple-expansion engines of the inverted cylinder type, supplied by Messrs. Humphreys, Tennant & Co., who also furnish the boilers. The collective power they guarantee for twelve hours' steaming, on natural draught, is 13,000 H.P., and 20,000 H.P. for four hours with forced draught, the corresponding maximum speeds being estimated at 20 knots for natural and 22 knots for forced draught, when the vessel is run in smooth water with everything working at its best. To accelerate speed and to preserve her steel bottom she is beautifully coated with the Suter, Hartmann and Rahtjen Composition Co's. well-known Rahtjen's Composition.

The short service appointed to be used when one of her Majesty's ships is launched was begun by the Rev. J. Buckley at half-past two. By this time, in spite of the inclement weather, which had rendered it necessary to have a canopy of tarpaulin over the platform at which the christening was to take place, a large number of visitors, in addition to those already named, including representatives of the Admiralty and of the Governments of Spain, Portugal, Brazil, and Japan, and other distinguished persons were present, while in the dockyard without a large gathering of mechanics and artisans and the general public, which must have numbered many thousands, had assembled. Mrs. Hopkins stood in readiness on the platform in front of the bow, and then half an hour or so was spent in knocking away the shores. This being accomplished, the bottle of wine customary on such occasions, which was suspended by a blue riband, was broken on the stem, the cord was cut and the weight released which dropped on to the dog-shores from which the supporting blocks had been removed, and as she gently glided into the water at 3.15 p.m. the stately vessel was gracefully named the *Blenheim* by Mrs. Hopkins. The directors entertained a number of guests afterwards at a luncheon, the chair being occupied by Mr. Arnold Mills. After launch the *Blenheim* was taken by two tugs into the Albert Dock, where she will be engined. The Thames Ironworks and Shipbuilding Co. has other two first-class cruisers in hand for the English Government, the *Grafton* and the *Theseus*, the construction of the first being well advanced, and good progress made in preparation for laying down the second in the slip vacated by the *Blenheim*.

A British Corporation for the Survey and Registry of Shipping.—At a largely attended meeting held in Glasgow on the 24th of July, under the presidency of Mr. Nathaniel Dunlop, of the Allan Line of Steamships, it was resolved to form a British Corporation for the Survey and Registry of Shipping, and the articles of association were approved of, on the motion of Mr. W. F. G. Anderson, of the Anchor Line, seconded by Mr. Archibald Denny, of Dumbarton. A committee of management was also appointed, including many leading shipowners, shipbuilders, marine architects, underwriters, &c. The objects of the corporation are threefold—first, the survey of ships, and particularly to approve and certify, on behalf of the Board of Trade, the position of the load line disc in terms of the measure passed during the present session of Parliament: second, to consider and determine what modifications on the load line tables framed by the Load Line Committee may become necessary and desirable; and third, if found desirable, to classify and register ships. On a first view it may appear as if this movement were needless on account of an already existing institution well able to overtake the work which this new corporation has assigned to itself. This can only be maintained, however, by those who are interested or who have not given the matter attention. It cannot, we think, be for one moment seriously questioned that the shipowners of this country are entitled to, and do right in securing, a more direct say in the matter of ship loading and kindred matters than they could possibly have if Lloyd's were entrusted with the work. If only for the sake of placing the load line work on a safe, solid, and equitable basis the institution of such a corporation as has just been formed is all-important. The best interests of British shipping shall be better secured by an institution so genuinely representative than they would be at all likely to be if vested in Lloyd's, an association already overweighted with responsibility and powers in this direction. It is to be hoped that the new corporation may have every encouragement to enter and progress in what must be said to be a sphere of immense responsibility and usefulness.

The Leeds Forge Co., Limited, Leeds.—News comes from New York under date the 19th June that the s.s. *Algonquin*, 1,805·61 gross tons, built in 1888 at Yoker, Scotland, was brought over to this country and employed on the Great Lakes in the carriage of freight. She was at that time fitted with six Purves patent ribbed furnaces, made by John Brown & Co., Sheffield, Eng. The partial collapsing of these furnaces on August 10th last made it necessary to withdraw the *Algonquin* from service for a while. Six of the celebrated corrugated furnaces (Fox's patent) made by the Continental Iron Works, Brooklyn, N.Y., have replaced those of the Brown pattern, and the vessel is now running again.

The Wages of Operative Shipbuilders on the North-East Coast.—On July 24th notices were received by the officials of the Boilermakers' and Iron Shipbuilders' Society on the Tyne, Wear, and Tees, and also at the Hartlepools, intimating that the employers would require a wages reduction of 7½ per cent. on October 1st, and a further reduction of the same amount on January 1st, 1891, making 15 per cent. in all. The notice for reduction, which is the outcome of a conference held at Sunderland on July 22nd, is to apply to all the sections of operatives composing the Boilermakers' and Iron Shipbuilders' Society.

Messrs. Cox & Co. of the Docks Iron Works, Falmouth, have secured a contract from H.M. War Department to build a twin-screw vessel of a new type, and intended for submarine mining service. The derricks, capstans, and their engines are to be arranged on a new principle. The machinery will be ordinary compound-surface condensing of 300 H.P.

Marine Boiler Flues.—Our attention has been drawn to the fact that in recent considerations of the respective merits of "corrugated thin" and "plain thick" flues, more especially in the discussion of Messrs. W. Kilvington and Alexander Taylor's paper on "Boiler Furnaces," read before the North-East Coast Institution of Engineers and Shipbuilders, it appears to have been entirely overlooked that during the last three and a-half years a new furnace has come to the front combining the advantages of both corrugated and plain without the disadvantages of either. After the experience which the "Purves" ribbed flue has furnished—nearly six thousand being in use by this time—it may fairly claim to have established its right to the above description, possessing as it does exactly the characteristics indicated as essential in marine boiler furnaces in the leading article of July number of Marine Engineer. The "Purves" ribbed flue combines great longitudinal strength with a sufficient amount of elasticity, resistance to collapse with small thickness, a preponderance of flat surface easy to keep clean, with solid Adamson flanges or strengthening ribs, saddle flanges of full thickness with only one weld in bottom, even for the largest diameter and longest furnace likely to be required for marine work, say 4 ft. 6 in. diam., 10 ft. long. Further, as the longitudinal section of the finished flue is produced in the manufacture of the plate before it is bent and welded, no disturbance of the weld takes place as in corrugating a welded plain flue, except in the very short length of the customary bell mouth now adopted at the front end.

LAUNCH OF THE PROTECTED CRUISER "PALLAS."

ON June 30th, there was floated out of No. 4 Dock at Portsmouth the second-class protected cruiser *Pallas*, which was laid down on July 1st, 1889, the christening ceremony being performed by Miss Guendolen Gorst, a daughter of Sir John Gorst, M.P. She is the first of the ships building at the dockyard under the Naval Defence Act, and has for sisters the *Pearl*, *Philomel* and *Phœbe*, under construction at Pembroke and Devonport, and the five vessels—namely, the *Pandora*, *Pelorus*, *Persian*, *Phœnix*, and *Psyche*—which are in course of building by contract under arrangement with the Australian Government for the purposes of colonial defence, and the names of which have been recently changed to the *Katoomba*, *Mildura*, *Wallaroo-Tauranga*, and *Ringarooma* respectively. Being intended for service on stations where docking accommodation is available, the *Pallas* is destitute of copper sheathing, but has a steel bottom coated with Hartmann Rahtjen's compositions to prevent corrosion and fouling. She measures 260 ft. between perpendiculars, and has a breadth of 41 ft., a mean draught of 15 ft. 6 in., and a load displacement of 2,573 tons. The weight of the hull is 1,250 tons. A watertight steel deck extends throughout the entire length of the ship, whereby protection is afforded to the engines, boilers, magazines, &c., and which is supplemented by the coal bunkers. The hull is largely subdivided by watertight decks and bulkheads, so that a bilged compartment can be isolated at will. Special protection is provided for the fighting stations of the ship, as well as for the necessary instruments, telegraphs, &c., that would be required for manœuvring in action. The *Pallas* is to be provided by Messrs. Hawthorn, Leslie & Co., Newcastle-on-Tyne, with two sets of inverted direct-acting engines, for which steam at 155lb. pressure will be supplied by four double-ended boilers. The indicated horse power at natural draught is 4,500, and with forced draught 7,500, the speed resulting being estimated at 16½ knots and 19 knots respectively. The continuous seagoing speed to be maintained on a four days' run is specified to be 14¾ knots under a natural draught horse power of 2,500. The coal capacity at load draught will be 300 tons, which, on the assumption that the speed will be limited to 10 knots, will insure the vessel steaming a radius of not less than 4,800 knots. The armament of the *Pallas* will consist of eight 4·7 in. and the same number of 3-pounder quick-firing guns, in addition to smaller machine guns and the usual torpedo equipment. The total estimated cost of the ship, including £54,410 for propelling machinery and £7,597 for guns, is £150,186. It is expected that the ship will be ready for commission by the end of the current financial year. The work of building has been in charge of Mr. A. T. Aslett, assistant constructor, under the direction of Mr. Champness, constructor, and the chief constructor, Mr. H. E. Deadman.

THE NEW UNION STEAMER "NORSEMAN."

ON Saturday, July 12th, the new steamer *Norseman*, which has been constructed at the Northam Works, Southampton, for the Union Steamship Company (Limited), for their intercolonial service, underwent her official trial trip in Stokes Bay, and attained a mean speed of 11·4 knots on the measured mile, developing 837 I.H.P.

The vessel is of the following dimensions:—Length between perpendiculars, 230 ft.; breadth, 30 ft.; depth in hold to main deck, 14 ft. 8½ in. She has been built of steel, to class 100 A1 at Lloyd's, under special survey, but the scantlings have been largely increased beyond Lloyd's requirements. The vessel is fitted with every modern convenience for the comfort of a large number of first, second, and third class passengers, and the speedy loading and discharging of cargo, and is fitted with water ballast in fore-peak and main and after holds. The poop deck, which is of teak, extends from forward of amidships to stern, and forms a long promenade deck, the boats being stowed on beams overhead, leaving clear the deck. At the fore end there is a top-gallant forecastle deck, which affords accommodation for the crew, and at the same time forms a house for the protection of the steam windlass, and a platform for working the anchors, hawsers, &c. The saloon, which is on the main deck, forward of the machinery space, extends from side to side of the vessel, and is handsomely fitted up with tables and revolving chairs for 30 first class passengers. The walls of this saloon are tastefully decorated with ornamental carved work, in various designs. The first class sleeping cabins are placed abaft of the saloon, on the main deck, and are fitted with patent wire-woven spring folding-up berths, and patent mahogany folding-up lavatories, which, while being exceedingly convenient, occupy the smallest amount of space. They are also fitted with electric light and electric bells, &c. The second class saloon and sleeping cabins have been arranged abaft the machinery space on the main deck, the fittings of the sleeping cabins being identical with those of the first class cabins. The ship is fitted with patent combined steam and hand steering gear, placed directly over the rudder-head; and there are no chains or quadrant to give any trouble. The chain cables are in excess of Lloyd's requirements, and the vessel also has three steam winches, of large and powerful make, capable of lifting heavy weights. The ventilation of the ship has received special attention, and the vessel is being fitted throughout with electric light by Siemens Brothers & Co.

The engines are on the triple-expansion principle, with three cranks, and are fitted with all the latest improvements. The cylinders are 16½, 26, and 44 inches diameter by 36-inch stroke, working pressure 160 lb. per square inch. The cylinders are fitted with liners and steam jacketed. The shafting throughout is of Vickers' steel, and extra large in diameter. The piston and connecting rods and all the forgings are of steel. The engines are fitted with steam reversing gear and steam turning gear, which can also be worked by hand. The surface condenser has a cooling surface of 1,400 square feet. The air pump is worked by levers connected to after-engine, and is fitted throughout with Beldam's corrugated valves. There are two centrifugal circulating pumps, with separate engines, each capable of supplying the condenser with the requisite quantity of water. These pumps are also arranged to draw water from the bilges of ship. Three large and powerful donkey engines are fitted in the engine room for feeding the boilers, pumping bilges, and for fire, sanitary, and wash deck purposes, also for filling and emptying the water ballast tanks. Special provision is made for pumping out the bilges in every part of the vessel by the main and auxiliary engines. The electric engine and dynamo is fitted in a recess in engine-room. The propeller is 13 feet diameter, 14 feet pitch, and 60 square feet of surface, fitted with four moveable blades of Vickers' steel, sheathed with brass at tips. There are two boilers, each 11 feet diameter by 10 feet long, built of steel, for a working pressure of 160 lb. per square inch. The total heating surface is 2,000 square feet, and grate surface is 66 square feet. There is also a donkey boiler 8 feet diameter by 8 feet 6 inches long, built of steel, fitted with feed donkey, &c., on the upper deck, for supplying steam at 100 lb. pressure to the winches, electric light, and auxiliary engines.

THE ROYAL MAIL STEAMER "CLYDE."

ON Sunday night, June 29th, the new s.s. *Clyde*, just completed by Messrs. R. Napier & Sons, of Glasgow, for the Royal Mail Steam Packet Co., arrived at Southampton, after a very satisfactory run from the Clyde. The steamer left the Tail of the Bank about noon on Saturday, and made the distance from the Cumbrae Lighthouse to the Needles in 29 hours 30 minutes, which is said to be the fastest run on record. During the run round, the contract six hours' trial was made at a mean speed of 17·9 knots per hour, being nearly a knot in excess of the guaranteed speed. The engines worked most satisfactorily throughout, and without the slightest signs of heating. The company on board included Mr. T. C. Tufnell, deputy chairman of the Royal Mail Co., with Mr. Spencer H. Curtis, a director, and Mr. G. Bowers, superintendent engineer; Dr. A. C. Kirk, and Mr. John Hamilton, of Messrs. R. Napier & Sons; Captain Zaloni, Russian Naval Attaché; Mr. Cornelius Thompson, of Messrs G. Thompson & Sons; Mr. Andrew Brown, the superintendent engineer of the Orient Co., Mr. Alexander Carnegie, Mr. J. Howard Colls, Mr. Charles Pantin, &c.

The *Clyde* is the last of four steel screw steamers of about 5,650 tons which Messrs. R. Napier & Sons have built for the Royal Mail Co. These magnificent vessels have been specially designed to meet the requirements of the company's West Indian, Brazil, and River Plate service; and in order to attain a high rate of speed, with the greatest economy, the hulls have been constructed upon fine lines, while the machinery consists of powerful triple-expansion engines, capable of indicating 7,000 H.P., and fitted with all the most modern improvements. The general dimensions are:—Length over all, 456 ft.; breadth extreme, 50 ft.; depth to spar deck, 33 ft. 4 in. They have been built to class 100 A 1 at Lloyd's, under special survey, and to meet the Admiralty requirements as armed cruisers. She is coated with Hartmann Rahtjen's Composition. The accommodation for the passengers is of the most luxurious description, and all the details have been carefully considered, with special reference to a first-class service in a hot climate. To admit of perfect ventilation, the dining-saloon has been placed upon the upper deck before the machinery, where there is no vibration, and is so arranged that family parties can dine together at separate tables. The sides of the saloon are finished in polished walnut, with exquisitely carved walnut panels from Florence, and the ends are fitted with artistically designed sideboards, bookcases, glass racks, &c., with a handsome organ at the forward end. A double staircase, with walnut rails and carved balusters, leads to the music-room on the promenade deck, which is decorated in a lighter style, and is finished in bird's-eye maple and satinwood, and supplied with a fine piano. On the other side of the landing is a comfortable ladies' boudoir, furnished in the same style as the music room; and further aft is the first-class smoking-room, fitted in polished mahogany and walnut. The promenade deck, upwards of 200 ft. in length, is entirely reserved for the first-class passengers, while the second-class have the poop for their own use. The accommodation for the latter is of a very superior description, but little inferior to the first-class, and comprises a handsome dining-saloon, comfortable ladies' cabin, smoking-room, and a separate suite of baths and lavatories. State-rooms for about 200 first and 40 second-class are situated on the main deck. These are exceptionally large and airy, many of them being adapted for families, and are fitted with all the most recent improvements for the comfort and convenience of the passengers, such as patent iron bedsteads with spring wire bottoms, folding washstands, pneumatic bells, electric light, &c. A special feature is the width of the passages, which are also very well lighted; and the lavatory arrangements, with marble baths, &c., are of the most complete description. Superior accommodation has also been provided for 500 third-class passengers in the after part of the 'tween decks, with portable iron beds, &c. The comfort of the officers has had special consideration, their cabins being large and handsomely fitted; and the crew are berthed in a large and roomy forecastle. The pantry and galley arrangements are replete with every convenience to provide for 1,000 people, and refrigerating machinery and chambers have been fitted for a sufficient supply of fresh provisions during the whole voyage. The entire passenger accommodation is heated by steam, and the electric light is fitted in every part of the ship. The most modern improvements have also been introduced for the rapid and noiseless handling of cargo and the efficient working of the vessel. The ship and machinery were constructed under the supervision of Mr. Bowers, the company's superintending engineer; and she is justly considered one of the most complete and artistically-fitted passenger ships afloat.

On July 3rd, the *Clyde* went for her trial trip in Stokes Bay, and the following are the results of four runs over the measured mile:—The first run was made in 3 minutes 41 seconds, equal to 16·289 knots per hour; the second in 3 minutes 18 seconds, equal to 18·181 knots per hour; the third in 3 minutes 27 seconds, equal to 17·391 knots per hour; and the fourth in 3 minutes 28 seconds, equal to 17·307 knots per hour; giving a mean speed of 17·292 knots per hour.

LAUNCH OF A POWERFUL DREDGER.

THERE was launched on Tuesday, July 15th, from the works of Messrs. Wm. Simons & Co., Renfrew, the powerful four-screw hopper dredger *Manchester*, which has been constructed to the order of the Manchester Ship Canal Co. under the direction of their engineer, Mr. E. Leader Williams, M.Inst.C.E.

This dredger is one of a new type and possesses several novel and interesting features in design and construction. A difference in this and other hopper dredgers is in the stern being divided, instead of the bow, for the projection of the bucket ladder, and in this manner having a solid instead of a divided bow, which is better able to withstand heavy seas. Another point is the mode of propulsion. This is effected by means of two lines of steel shafting carried fore and aft, to which are fitted four steel propellers, viz., two at bow and two at stern. This enables the vessel to steam up a narrow and crooked channel more easily and commence dredging operations, and run out to sea again without the necessity of turning, as the vessel is designed to steam either ahead or astern with equal facility, a considerable saving of time and less risk of accident being the result. Three large rudders, *i.e.*, two at the stern and one at the bow, are provided for the purpose of rapid steering, and these are controlled from the bridge, which is forward of the funnel, by means of steam steering gear.

The hull is constructed chiefly of steel and is subdivided into ten watertight compartments.

The hoppers, which are placed amidships, have a capacity for 850 tons of dredgings, and the bucket girder is fitted with an endless chain of steel buckets working in a central well opening through the stern of the vessel, and is adapted to dredge to a depth of 35 ft. below the water level.

The vessel has been fitted with the builders' most recent improvements, also with their patent traversing bucket ladder, by means of which it is enabled to cut a channel in advance of the stern through banks and other ordinary material, or in other words dredge its own water to float in, thus obviating the necessity of waiting the return of the tide.

The dredger is fitted with two sets of triple-expansion three-crank engines and two steel multitubular boilers for a working pressure of 150 lbs. per square inch. The high-pressure cylinder has valves. Steam starting gear is provided. An auxiliary steel donkey boiler is provided for supplying steam to any other of the auxiliary engines, it has also connection for circulating the water when raising steam in the main boilers.

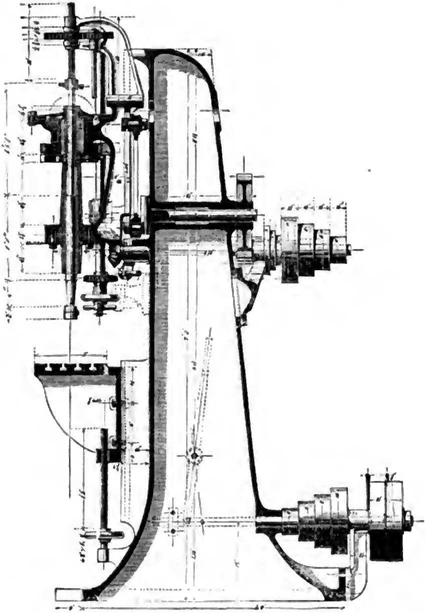
The buckets have a capacity to load the vessel with ordinary material in an hour. The buckets themselves are a speciality and patent of the constructors. They consist of a set of steel backs with links cast on, and these are so designed that they can be fitted with removable and interchangeable steel bodies and lips. In this way the large bodies can be removed from the chain of bucket backs without breaking its continuity, and when hard material has to be dredged a set of special steel bodies of lesser capacity can be fitted on the same bodies, and say every third back can be fitted with ripping claws or picks for disintegrating the material. In the dredging gear improved frictional arrangements are fitted between the engines and the top tumbler for the purpose of taking the strains arising from sudden shocks to the dredging machinery when working in hard ground. Besides the dredger's own hopper shoots side shoots are also fitted for loading hopper barges. At the bow and stern improved steam crab winches for controlling the mooring chains are fitted. Towing gear is also provided.

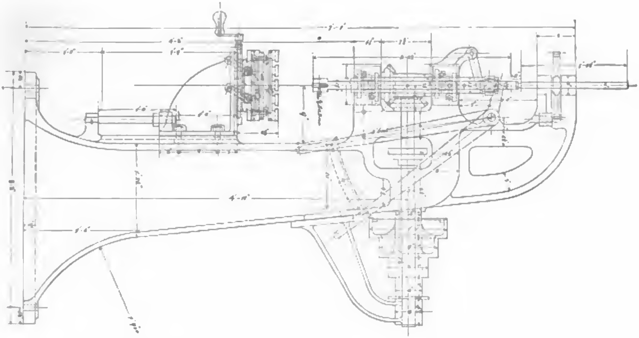
The construction of the *Manchester* was superintended by Messrs. J. P. De Winton & E. G. Carey, acting on behalf of the Manchester Ship Canal Co.

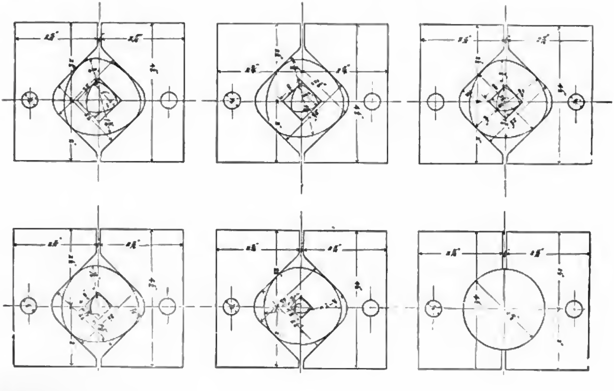
THE GIBSON AUTOMATIC BELL-BUOY.—On Friday evening, the 11th July last, we had, on the invitation of Mr. Jasper Gibson, of 51, Lincoln's Inn Fields, the inventor and patentee of this most useful buoy, an opportunity of witnessing its practical working. In our May number we gave a general description of this invention, to which we refer our readers. On the present occasion we had the pleasure of seeing the different parts of the signalling arrangements put together on the buoy proper, as it lay moored to the steamboat pier at Westminster Bridge. At half-past seven it was floated up the river and anchored opposite the terrace of the Houses of Parliament. The automatic arrangement, by which the fog bell is rung at various intervals, worked admirably. Its superiority over other bell-buoys consists greatly in its ability to give regular warning in thick weather, even when the sea is almost a dead calm. Every little ripple on the water acts on the float in such a way as to accumulate sufficient power to make the bell ring out at least once a minute. The experiment we witnessed showed most conclusively the sensitiveness of the mechanism, as when under normal conditions the bell rang from two to three times a minute, but when the waves caused by the passing steamers acted on it the hammer struck the bell proportionately oftener per minute, showing its value in a storm. The trial was a decided success, and this bell-buoy should prove an aid in preventing loss of life at sea by shipwreck, which ought to tell considerably on the marine mortality tables.

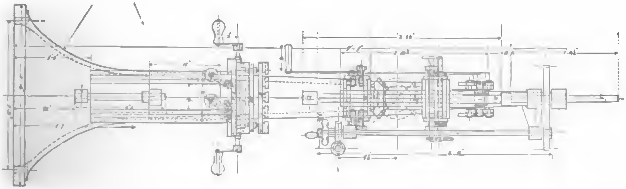
THE AINLEY-OAKES SQUARE DRILLING MACHINE.

WE had, on Wednesday, the 16th July, the satisfaction of seeing at work, in No. 2, Old Broad Street, a very clever machine designed to supply the long felt want of a *square* hole drill. Square holes, as is well known, possess many advantages over round ones, but their more general adoption has been retarded on account of the expense attached to their formation. Hitherto, when a square hole was required a round one was drilled, and the square formed by the tedious and expensive method of hand-filing. We understand that the expense of making square holes in iron plates, &c., has hitherto been about 36 times that of making round ones. The peculiarity of the Ainley-Oakes machine, which claims to drill square, polygonal, or in fact any sort of hole as cheaply as round ones, consists in the construction and arrangement of the spindle to which the tool holder is attached. The machine is similar to an ordinary drilling machine in the manner in which the spindle is driven and fed automatically downwards. The spindle, however, consists of three concentric parts, the outer sleeve carrying a bevel wheel, and driving the intermediate sleeve by means of a keyway and feather; an intermediate spindle having a set of cams or cardanic circles formed upon each of its ends. These cams, of which there are five on each end, have a depth of $\frac{9}{16}$ in. each, and a clearance space of $\frac{1}{16}$ in. between them. They are so arranged that the upper one of each set is suitable for drilling a $\frac{1}{2}$ in. square hole, the second $\frac{5}{8}$ in., the third $\frac{3}{4}$ in., the fourth $\frac{7}{8}$ in., and the fifth 1 in. There is thus a set of cams for each size of hole to be drilled. Lastly, an inner spindle carrying the cutting tool, and capable of being fed downwards either by hand or by an automatic feed, and is in every respect similar to the sliding spindle of an ordinary drilling machine. The bearings or

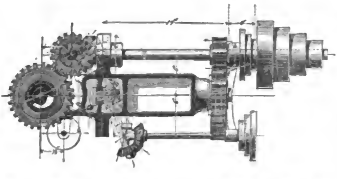


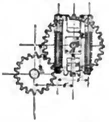


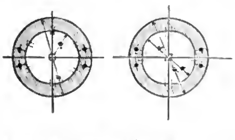




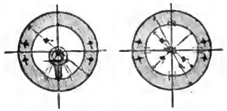
guides for the spindle consist of flat, very hard steel plates, made in halves, and capable of being adjusted by means of right and left-handed screws, and suitable gearing is provided with handles and clamps. These plates are four in number, the two inner ones having round holes, and engaging with the circular part of the spindle for drilling round holes. These are run back when the machine is drilling square holes, and the upper and lower plates, which have square holes in them, are screwed up so as to engage with the cams to give the required motion to the spindle. The pair of cams with which the square plates engage, is determined by the position of the intermediate spindle, which is capable of being raised or lowered by a hand lever or lifting gear. This lever works in a quadrant, and is provided with five notches corresponding with the five sizes of holes which the machine can drill. The cams, which are shown in the engraving, are set out thus:—A square hole is described equal to the hole to be drilled. From any point in one side of the square an arc of a circle is described, with a radius equal to the side of the square. From the points where this arc intersects the sides of the square, other equal arcs are described completing the curve triangle. The square in which the cam is to revolve is now drawn, and from each of the verticles of the curve triangle two arcs are described, which complete the figure shown. The point of the cutting tool, which cuts with one edge only, must be situated beneath one of the angles of the triangle, and a different tool used for each size of hole.







Our illustrations show the original and also Tyler & Ellis's improved machine, in which latter the spindle moves about the centre of a ball joint, the top end only being provided with roller or wheel which travels round the inner edge of an annular template, being pressed outwards by a pair of spiral springs. The inner spindle carrying the tool serves a different purpose to that of the Ainley-Oakes machine: here, by lowering it, the size of the hole drilled can be varied with great accuracy, while to drill a parallel hole the entire head of the machine is lowered, moving in suitable guides in the framing. The templates in this machine can be easily changed and any desired shape of hole cut, and the tool is so made that its cutting edge terminates on the centre line of the spindle, and is suitable for any sized or shaped hole. The machine is likewise fitted with a slotting motion, so that shapes may be finished of the most complicated form. The action of the machine when at work is very curious to watch, but the finished holes are very quickly and accurately drilled.



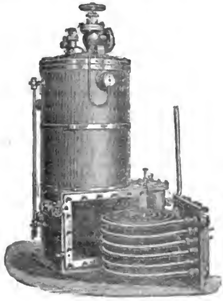
Both machines are, of course, patented, and are being made by the Ainley-Oakes Square Drill Company, Limited, 58, Lombard Street, London, E.C. When we bear in mind that, in some of the larger mechanical workshops, as many as over 100 drills of different kinds are constantly employed in drilling round holes, a large number of which are afterwards formed into square holes or holes of other shapes, by the expensive and tedious process of filing the corners by hand, we think it reasonable that when the great labour-saving qualities of this machine become recognised, it will take its place in every workshop where ordinary drills are now in use.

RAYNER'S PATENT EVAPORATOR.

On the first introduction of high pressure tubular boilers for marine purposes sea water was used, as it had been before in low pressure times. The amount of scale formed, however, was found to be so serious, and the difficulty of removing it from between the tubes so great, that it became a necessity to supply a distilled water feed—of course at an extra expense—rather than run the risk of burning and destroying the tubes and plates in inaccessible parts where the deposits were perforce allowed to collect, until such time arrived when a complete clean out could be made and the tubes withdrawn.

The amount of water required for auxiliary feed has been found to be from 1 to 5 tons each 24 hours per 1,000 I.H.P. To supply this auxiliary feed a good evaporator becomes a necessity for steamers, and three considerations have to be kept in view in deciding what sort of an evaporator should be adopted, namely, temperature at which evaporation takes place, easy means for cleaning scale from it, and economy of space and connections in fixing and working.

In Mr. Rayner's patent (shown in our illustration), which has now been in extensive use for nearly three years, these points have been carefully studied and carried into effect, and where experience has pointed out some small defects, these have been removed and the apparatus is now as perfect as possible. To work the evaporator the water is first admitted, and when the proper level is reached the steam valve is opened and then the vapour valve in connection with the main condenser, so that about 10 in. of vacuum shows on compound gauge; the engineer can then leave it to work without further attention, except to blow out brine every two hours. This is done by simply closing the vapour valve and opening the brine cock, the pressure which immediately rises in the evaporator will blow the brine overboard or into the bilges, as may be arranged. When all the brine is out, shut the brine cock and open the vapour valve, and the work will go on again as before.



The advantages claimed for the evaporator under consideration are that the salt water is boiled under a vacuum in the evaporator at a temperature of about 170° F., whereas if a pressure of say 15 lbs. per square inch is used, then a temperature of 250° is required to effect the same result. The water supply for the evaporator is taken from the discharge water from the main condenser, and as the temperature of this is generally about 100° F., its temperature has only to be raised in the evaporator about 70° to produce vapour. This amount of heat only has to be given off by the live steam taken from the boiler.

The water supplying the evaporator is admitted through an automatic valve, the vacuum drawing the water in, and the valve closing when the proper water level is attained, thus preventing the evaporator filling up with water when steam is shut off. No pump is required.

Priming is prevented by a large amount of steam room, and a series of inside plates, together with a special water circulator, and a vacuum of from 5 in. to 15 inches can be carried without the fear of this occurring. As we have stated before, the water cannot rise above the proper level even if the steam were shut off and evaporation should, from any cause, cease, and thus the water could not continue to be fed into the evaporator and finally find its way into the boilers, as it might do if a pump were used. Again, in the important matter of scale, the salt water being boiled under a vacuum and not being more than 170° in temperature, this is not so hard on the coils as it would be if boiled under a pressure, and it takes much longer time to deposit.

The construction of the copper coils used as a heating medium in this evaporator is much more elastic than an ordinary helical coil; in fact it works like a Bourdon gauge tube, expanding with the pressure of steam and contracting when the steam is turned off; and further, when the brine is blown out and the fresh supply of water admitted, a sudden contraction of the coil takes place and cracks off the scale, which falls to the bottom.

Recently, we understand, after a round voyage to Japan and back, without cleaning, the engineers broke the door joint, expecting to have to clean the coils, but they found that these had already cleaned themselves, and all that was left for them to do was to clear out the scale which had fallen to the bottom. When it is desired to see the state of the coils, all that is necessary to be done is to break the door joint and withdraw the coils, in which operation, as our illustration shows, no pipe joints are interfered with, and after the examination is made the coils are replaced and the door re-jointed, the whole being done in something like half-an-hour. With this arrangement of door no overhead space is required above the height of the apparatus itself, but only a space in front equal to its diameter, and in the large size evaporators there is a special handling gear fitted to take the weight of the door and coils, which by its means can be easily withdrawn and replaced by one man.

We understand that a very considerable economy in the fuel used in boilers is effected where these evaporators have been fitted, and Messrs. Caird & Rayner, the makers, of 777, Commercial Road, London, send us a long list of steamers using them. We may add that the Board of Trade have passed and approved of this evaporator for passenger ships.

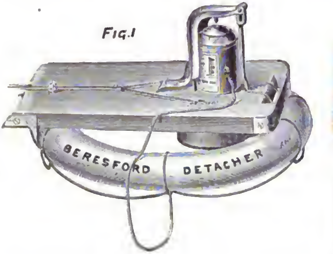
THE HOLMES "BERESFORD DETACHER."

THE apparatus we here illustrate is designed for saving life at sea by the instantaneously disengaging a *life-buoy* with a Holmes flag brand inextinguishable self-floating *rescue-light* attached, in such a manner, that the operation of releasing the life-buoy, at the same time automatically perforates the rescue-light, and of course indicates the position of the buoy.

The arrangement is simplicity itself, and is named the "Beresford" in compliment to Lord Charles. Fig. 1 shows the apparatus ready for use. The life-buoy is held in position by a loop threaded round the disengaging rod and supported on the other side by two brass hooks. The flag brand rescue-light is seen in position and attached to the life-buoy by a cord, and the disengaging wire cord is shown, which may be led from the detacher to any desired part of the vessel.

Fig. 2 shows what takes place when the cry is raised of "Man overboard." The apparatus being fixed at say the ship's stern, and the releasing cord led on to the bridge, the cord is no sooner pulled by the officer in charge than the life-buoy with its rescue-light attached is instantly floating astern. As we have already said, the moment this light touches the water it bursts into a brilliant flame, which continues burning for about an hour, and indicates to the submerged man or the rescue crew the position of the life-buoy.

FIG.1



It would be difficult to over-estimate the great advantages this simple but most effective apparatus renders to the object for which it is designed. Supposing a man was to fall overboard from the bows or the port or starboard sides of a steamer or sailing ship, the usual cry being raised the officer on the bridge at once disengages the buoy and light, and by the time the man reaches the stern of the vessel, some two or three seconds, there is the means of saving his life, even if he cannot swim, within his reach. At a 16-knot speed an elapse of say six seconds means that the buoy will be in the water at a distance of about 45 yards from the place where the man fell, of course a less speed would mean a speedier rescue.

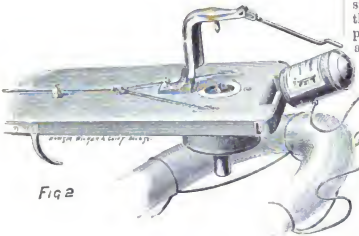


FIG 2

Figs. 3 and 4 show the Beresford Detacher in position and ready for use. Fig. 5 is a section of a Holmes flag brand inextinguishable self-floating rescue light; the invention of Mr. Joseph Holmes, who is the original introducer of the first inextinguishable light that bears his name. A is the tube up which, after automatic perforation, the water enters on the light striking the sea; B is a return covered tube to prevent the escape of the generated gas except through its proper channel; C is a perforated disc to ensure direct and complete contact of chemical with inflow of water throughout; D is the chemical which revolves the gas as generated by the water; E is the outside can containing the whole; F is the flotation chamber; H the copper caps containing the oxygen ingredient which, on becoming heated by the passing flame, increases its brightness and lengthens its duration of burning. The great superiority of this light over the old and obsolete

FIG.3

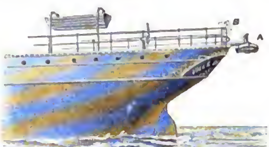
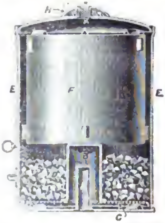


FIG 4.



pattern is obvious. The Royal Mail s.s. *Thames* (Fig. 4) a steamer of 5,600 tons and 7,000 H.P., is fitted with the Beresford Detacher. This steamer is 456 ft. in length, 50 ft. beam, and depth 33 ft. 4 in. She carries 1,000 passengers and has a speed of 17¼ knots. The detacher is fixed on the starboard quarter and operated on from the bridge, a distance of 240 ft., the wire being led clear of all meddlesome people and working of cargo or sails. We have no doubt but that this useful invention will become generally adopted on both steam and sailing ships, as the cost is small, and the simplicity and certainty of action indisputable.

NAVAL ENGINEER APPOINTMENTS.

The following Appointments have been made at the Admiralty from June 25th to July 25th, 1890:—

Chater, James D., staff engineer to the *Rover*, to date July 1st.
Denny, John T. H., staff engineer to the *Terror*, to date July 2nd.
Fedarb, Wm., acting chief engineer to the *Aleck*, to date July 11th.
Ford, Francis, staff engineer to the *Edinburgh*, to date July 1st.
Laird, George F., staff engineer to the *Asia*, additional, to date July 12th.
Parker, Wm. R., engineer to the *Blenheim*.
Stevenson, John L., staff engineer to the *Pique*.
Willby, Richard G., chief engineer to the *Volage*, to date July 10th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, July 24th, 1890.

Teak.—The consumption continues good, notwithstanding the falling off in demands for shipbuilding; and although the deliveries are constant the landed stock is still heavy, and there is only a moderate quantity of really good wood on hand. The forced auction sales which have taken place during the month were satisfactory considering the character of the wood offered, but this has created a scale of low figures for inferior timber. The result of the sale has had no influence upon the market price of first-class shipments.

The tonnage chartered to load from Burmah is about 3,000 only, as against 22,500 for the corresponding period last year.

The Bangkok charters are larger. If, however, the character of this wood does not improve it can have little effect upon the demand for first-class teak. Renewal of shipbuilding orders may be confidently looked for in the near future, which will have the effect of strengthening the market very considerably.

Greenheart.—There has been an unusual briskness after the long dull period we have recently passed through. The parcel just arrived has changed hands, some of the wood already having gone into consumption. A demand has suddenly sprung up, making room in this market for a cargo at a reasonable price.

Mahogany.—The market remains firm for medium sized and sound wood, but small logs are weaker in value. Trade is fairly good, and deliveries keep up their usual average. A large order is expected to be placed in the market, which will appropriate most of the sound and better class portion of the parcels now here; this should make prices still firmer.

Walnut.—The log trade is especially good, and a fair business is doing in lumber of good description; but for the commoner class of stuff a poor demand exists, and the market is more than fully stocked with it.

Padouk.—The small enquiries are not so numerous this month, but it is generally understood that some large private transactions have taken place, leaving the stock now in first hands considerably reduced. This wood has found great favour in the cabinet trade, and is likely to push its way into general consumption.

American Oak.—In boards and planks there is a fair amount of business, but at low figures, and the market is fully stocked at present.

Considering the nearness of the holiday season, the hardwood market may be described as fairly brisk; which points to the soundness of trade in this and other directions.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE customary "fair holiday" period intervening, the month's doings in the Clyde shipbuilding and engineering industries have been but slow and unimportant.

Launches have not been so numerous as during last month: more activity having taken place in connection with the fitting-out and speed trials of vessels afloat.

Messrs. Russell & Co., of Port-Glasgow, completed during the month the *Strathallen*, a screw steamer of over 2,000 tons for Messrs. Burrell & Sons, of Glasgow, this being the fifth vessel completed by the firm for Messrs. Burrell & Sons within two years.

The most noteworthy vessel sent off the ways during the month was undoubtedly the *Manchester*, a powerful four-screw hopper-dredger, constructed by Messrs. Simons & Co., of Renfrew, to the order of the Manchester Ship Canal Co. This unique vessel, which has been built under the direction of Mr. E. Leader Williams, M.Inst.C.E., engineer for the Canal Co., is one of a new type of dredger, possessing several novel and interesting features in design and construction, which are elsewhere described in this issue.

In point of size the most noteworthy vessel launched during the month was the *Prinses Sofie*, a steel screw steamer of 3,450 tons and 2,600 I.H.P., produced by Messrs. Caird & Co., of Greenock, for the Stoomvart-Maatchappij Nederland of Amsterdam, intended for the passenger and cargo traffic between Holland and the colonies.

During the month the following new contracts have been placed:—Messrs. Russell & Co., Port-Glasgow and Greenock, have arranged to build a sailing ship of 1,700 tons for Messrs. Thos. Williams & Co., of Liverpool, to replace the *Cambrian Duchess*, which was lost recently. The same firm of builders have contracted with Messrs. George Milne & Co., of Aberdeen, to build two steel sailing ships, each with a carrying capacity of 2,300 tons. A similar order has been placed in the hands of Messrs. A. McMillan & Sons, Limited, Dumbarton, the new vessels being intended to form the nucleus of a fresh line, to be employed in the Eastern and Western general trade. Messrs. D. J. Dunlop & Co., Inch Works, Port-Glasgow, have contracted to build a steel screw steamer for passenger and cargo service for the West Indies. The new steamers, which will have 'tween-deck accommodation for a large number of cattle, will be supplied by the builders with triple-expansion engines to attain a high rate of speed.

The new boat for cross-river communication at Finnieston, in the harbour of Glasgow, was placed on her station on the 16th July. The new vessel, which is from the docks of Messrs. Simons & Co., Renfrew, and bears evidence of that firm's skill and ingenuity, carried on her first passage across the Clyde an open carriage containing the Lord Provost and other dignitaries of the city of Glasgow. At a luncheon which followed the ceremony, it was stated that the want of a vehicular ferry to Finnieston had been the cause of great anxiety to the Clyde Trustees for seventeen years. The performances of this new cross-river medium will certainly be watched with exceptional interest.

The survey instituted in connection with the "Direct Route" of a ship canal between the rivers Forth and Clyde has just been completed by Messrs. Crouch & Hogg, C.E., of Glasgow. Mr. J. Law Crawford, writer, the secretary of the committee, has been asked to read a paper on the subject at the International Congress on Inland Navigation, to be held in Manchester on the 28th July and following days.

A statutory meeting of Messrs. A. & J. Stewart & Clydesdale, Limited, was held in Glasgow on the 11th July, Mr. Andrew Stewart presiding. The business was purely formal and of little interest to shareholders, but it was stated that, by Act of Parliament, companies were required to appear before the public four months after their formation. The fact was that the shares of the company had been applied for to the extent of £160,000, or four times the amount offered for subscription.

The practical work concerned with the holding of an Industrial Exhibition in the east end of Glasgow has now been begun. The guarantee fund of £5,000 has been more than subscribed for, the list of guarantors containing the names of Sir John N. Cuthbertson, Messrs. Duncan, Stewart & Co., John Tullis & Son, I. Templeton & Co., Alley & MacLellan, &c.

Mr. Archibald MacLellan, who for several years has filled the position of secretary to the Steel Co. of Scotland, has been presented by his old colleagues and friends with a handsome testimonial on the occasion of his succeeding to the managership of Goodwin, Jardine & Co., Limited, a steel making firm, which starts with the brightest prospects.

The Dock Commissioners of Leith are at present considering plans for the extension of the docks, the scheme including a large dock for ocean liners to the north of the Edinburgh dock, and improvements in the direction of Newhaven.

At a meeting of the harbour trustees of Irvine, held on the 15th July, it transpired that all that the recent deputation to London claimed to have accomplished was that they had brought the position of Irvine harbour prominently before the three great railway companies of Scotland. It had been previously reported that the North British Railway Co. were very desirous of purchasing the harbour.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—During the half-year just ended it has been more than once indicated in these notes that a reduction of wages rates in the shipbuilding trade was inevitable, and the correctness of the forecast is now shown by the fact that a proposal for a general wages reduction is being discussed by the employers and the representatives of the operatives. That the demand of the employers will either be wholly or in part acceded to there can scarcely be a doubt, as trade has largely fallen off, and the operatives, whose leaders cannot be insensible to the fact, are receiving more wages now than even in 1883, when the highest earnings of any previous year were exceeded. Very few new orders are being placed, and such as have been negotiated for lately were taken at greatly reduced prices—prices, indeed, which will necessitate a general wages reduction of at least 10 per cent. to give the shipbuilders some security from actual loss on the contracts. It is indisputable that these contracts could only be obtained by the inducement of reduced prices, and the builders who accepted them were no doubt influenced by the expectation that the operatives would rather be employed at slightly lessened wages than be left without any employment whatever. It is, indeed, certain that a reduction of wages will have to be faced at an early date, and for the sake of all concerned it is to be hoped that the men will have the good sense to render complications unnecessary, by agreeing to what the employers propose, as absolutely necessary for the good of the trade. On July 16th an interesting event took place at South Shields, the first iron vessel built in the yard of Messrs. J. P. Rennoldson & Sons having been put into the water in the presence of a numerous company. Messrs. Rennoldson have for many years carried on the work of building wooden ships, but as there is now a demand for the type of vessel of which the one launched on the date named is a good example, the firm have decided to keep pace with the times by making the construction of iron vessels the principal feature of their business in future. With this object in view, they have entirely re-arranged the yard, making it practically a new concern, provided with spacious machinery sheds, new joiner's shop and draughting loft, frame and plate binding furnaces, &c. They have also put down a sufficient amount of modern machinery, and have, on the whole, made the yard one of the most compact and best appointed—speaking only of course of such establishments as are devoted to the building of fishing vessels, river steamers, ferry boats, &c.—in the kingdom. The firm have an excellent slipway in the yard, on which they can carry out repair contracts with great convenience and despatch. The firm are also well known as builders of marine engines, and the vessel launched on the 16th will be fitted with engine and boilers manufactured by them at their own works. This vessel, it may be stated, has been ordered by the Boston Deep Sea Fishing Co., Limited, and is intended for deep sea trawling. The firm have three other vessels of similar type on the stocks, and the keels for three more to follow, are in the yard. If the outlook for shipbuilding of the ordinary kind is depressing, the prospect of good trade in this particular department of the industry is excellent, and so far as the establishment just spoken of is concerned, there is no likelihood of slackness manifesting itself for many months to come. Messrs. Hepple & Co., of North Shields, appear to be also well provided with work, and have recently booked an order for two vessels of the class that has just been referred to. Messrs. T. & W. Smith have now but one vessel on the stocks—two berths being vacant—and when the launch takes place, which will be very shortly, there is little likelihood of the vessel being succeeded by another. The firm, however, have so far had an excellent year in repair work, and they have now one or two good contracts in hand. Messrs. Readhead are fitting out a large steamer, built to the order of Cardiff owners, and named the *Charles T. Jones*. They are among the few firms on the river who have all berths occupied, there being five vessels on the stocks, two of which are being plated, and three in earlier stages. At the Edwards Shipbuilding Co.'s yard, where a large vessel is nearly completed, another keel has recently been put down, and at the Tyne Shipbuilding Company's yard one of the four berths has just been rendered vacant by the launching of the steamer *Tripoli*, built for Liverpool owners. The Palmer's Shipbuilding and Iron Co. are carrying out extensive alterations on a large foreign steamer, which was built at their Howden yard about a year ago, but has since made several voyages. It would seem that the intention is now to adapt her for employment in a different trade to that for which she was originally intended. Messrs. R. Stevenson & Co., Hebburn, are rapidly getting ready for sea the fine steamer *Glen Caladth Tower*, launched by them a few weeks ago, and are making good progress with the construction of the two large vessels that are still on the stocks. The firm have recently booked an order for a large steamer, but only the preliminary work of designing has yet been entered upon. Messrs. Hawthorn, Leslie & Co. are completing the fitting out of the handsomely designed Russian passenger steamer launched by them a few weeks ago, and are engining the sister vessel, which was launched early in the present month. They have a large vessel in the graving dock undergoing repairs. Messrs. Richardson & Co. launched on the 19th inst. a large vessel named the *Enskar*, and another is well advanced towards completion. The firm have just now some large alteration or repair contracts in hand. Messrs. Schlesinger, Davis & Co., whose yard for some time past has been absolutely empty, have just put down the keel for a vessel of somewhat small size. Messrs. Armstrong, Mitchell & Co. have now but three vessels on the stocks at their Low Walker yard, six berths being empty. Three oil-carrying steamers, the *Gelstemunde*, the *Brilliant*, and another that have been ordered by an important German company, are being fitted out in the river. Messrs. W. Dobson & Co. are completing the fittings of the passenger steamer *Hosince*, and the yard is kept pretty busy with the work of two vessels that are still on the stocks. One of these, which is of large size, is understood to be building for a local partnership Messrs. Wood & Skinner have still their berths well filled, and are getting ready for sea the s.s. *Tamarind*, owned at Christiana.

Engineering.—The Palmer's Co. are engining at their sheerlegs the large steamer *Arab*, launched by them a couple of weeks ago, and other vessels are awaiting their machinery, the heavier parts of which cannot be placed in position, excepting by means of the powerful lifting apparatus referred to. The Wallsend Slipway and Engineering Co. are at the time of writing engining the new steamer *Tripoli*, and have also beside the quay the large steamer *Inchlonga*, the engines of which are to be overhauled and altered. The North Eastern Engineering Co. are repairing or altering the engines of the s.s. *Energia*, which for some time past has been moored at their jetty. The Tyne Boiler Works Co., Limited, are supplying to the large passenger steamer *Sumatra* two new boilers of Siemens-Martin steel, the dimensions of which are 14 ft. diameter by 10½ ft. in length. They are being constructed to work at a pressure of 160 lbs., as the old compound engines of the vessel are to be tripled. The vessel, which formerly belonged to one of the principal passenger lines, is to be put through a complete survey, and it is probable that this will be done at some of the repairing establishments on the river. Messrs. Eltringham, of South Shields, are putting new boilers in the Sunderland steamer *Dago*, and have several similar contracts to proceed with. Messrs. Baird & Barnsley, of North Shields, have just completed the engining of a large trawling vessel, and have orders to supply the engines and boilers to five other vessels of a similar class. The factory is at present very busy, and will be kept so for the remainder of the year. In spite of the increasing slackness in shipbuilding, the manufacture of patent anchors keeps pretty brisk. Mr. George Tyzack, of South Shields, is flooded with orders for the particular type of anchor with which his name is identified, and the manufacturers (Messrs. Abbot & Co., Gateshead) are obliged to utilize their resources to the fullest extent to keep pace with the demand. In the chain-making shops there is also a fair business being done. We note that the proprietors of a new speciality for the prevention of corrosion and pitting in steam boilers, but more especially in marine boilers working up to high pressures, have opened offices and works at Newcastle and Cardiff, and are already doing a large and rapidly growing business. The speciality which is called "Zynkara," is a basic solution of zinc and soda, and has been proved to be a most effective substitute for the zinc plates that have hitherto been used at an enormous cost (speaking, of course, relatively to the effect produced) in marine boilers for protective purposes. Some of the most important steamship owning companies in this and other countries have now become regular users of the "Zynkara," and the proprietors are in daily receipt of most flattering testimonials as to the unvaryingly good results arising from its use. The "Zynkara" is fully protected by patent, and the head offices of the company have been established at 34 and 36, Side, Newcastle.

THE WEAR.

Shipbuilding.—During the month a limited number of orders have been secured by Wear builders, but in every instance at rates much below those lately current. Messrs. Short Brothers have been among those firms who have thus opportunely added to the number of their prospective work engagements a large vessel for the Neptune Steam Shipping Co., constituting the addition to the order book, in their case. Messrs. R. Thompson & Son are said to have contracted for the building of a large oil ship, and they have disposed of a vessel which is now the sole occupant of their stocks, and which is understood to have been put down on "spec." At Mr. Laing's and also at Messrs. Doxford's yards work is still plentiful. The Sunderland Shipbuilding Co. are busily proceeding with the construction of a passenger vessel, and have recently launched a large steamer ordered by the Hansa Co., Hamburg. It is understood that they have another vessel to build for the same owners, but it has not transpired that any other orders are in hand. The Strand Shipbuilding Co. sold to Spanish owners a large vessel that has been some time in course of construction, and which at the time of sale was nearly completed. Considerable alterations will now have to be made, and much needed employment will thus be found for a few hands. Messrs. J. L. Thompson & Sons, of the North Sands Yard, have a couple of berths vacant, but it is understood that they have secured some orders lately, and will probably be in a position to occupy them again very shortly. Messrs. Blumer & Co. launched a vessel on the 19th inst., which was named the *Lynton*, and has been built to the order of Messrs. John Holman & Sons, London. There are still two vessels on the stocks, and an equal number occupy the building berths of Messrs. S. P. Austin & Sons, Panns Dockyard. Messrs. Osborne & Graham are about to launch a locally-owned vessel, which will be fitted with Mason's patent skylights. We understand that these ingeniously contrived appliances have given great satisfaction wherever they have been introduced, and it is pretty certain that in time they will come into extensive use.

Engineering.—At all the marine engineering establishments there are vessels receiving their machinery, and as repairs and renewal contracts are pretty numerous, work in these establishments has as yet shown scarcely any indications of falling off. The Scotia Engine Works, which since their opening some two years ago have been exceptionally successful, are still quite full of work, some of the engines in progress being of the triple, while others are of the quadruple-expansion type. The large steamer *Somerton*, of Hull, is lying beside the wharf getting some important repairs done to the engines, and she will subsequently be removed to one of the local yards for the purpose of having certain alterations carried out in her structural arrangements. The s.s. *Queen*, of Sunderland, is also having alterations done to her engines at the works. The establishment known as the Pier Engine Works, situated at the entrance to the south dock, and admirably adapted for the effective carrying out of repair contracts to the hulls and engines of steamers, has now become the exclusive property of Mr. R. J. Smith, who lately occupied the position of a principal partner in the company, and was formerly superintendent engineer to Messrs. Pinkney & Sons. As Mr. Smith will doubtless give a large amount of his personal attention to the business in future, it may be assumed that the place will be conducted in a way to secure extensive patronage from owners using the port. The strike of miners at Monkwearmouth is still unsettled, and the men occupy their time with daily processions and meetings. Matters must soon be brought to a crucial point, however, as the men have received notice to quit the houses occupied by them, and which belong to the colliery company. Eviction will follow unless a settlement is effected, but perhaps the dread of the former may prove a prime factor in bringing about the latter. It is understood that the Monkwearmouth Foundry is to be considerably enlarged, and a piece of ground adjoining the premises has been acquired with that end in view. When the extension is carried out, it is probable that castings of greater weight than have hitherto been attempted will be produced at the works.

The Hartlepools.—The shipyards continue to have the building berths pretty well occupied, and the approach of the coming slackness can hardly be said to be so much felt here as at some of the larger centres. In the engineering establishments work is still abundant, repair contracts forming a large part of the business in hand. The substitution of the 53-hour for the 54-hour working week was, it may be stated, commenced on July 5th. Since the compilation of our last report Messrs. T. Richardson & Sons have completed and placed on board at their sheerlegs the machinery of the following vessels:—The s.s. *Calcutta City*, for Christopher Furness, Esq., of West Hartlepool. This ship is fitted with triple-expansion engines 22 in., 35 in., 59 in., by 39 in. stroke. There are two large single-ended boilers, working at 160 lbs. pressure. The s.s. *Baria*, for the Hamburg-Calcutta line, Hamburg. This ship, which was built by Mr. James Laing, Sunderland, is fitted with the latest type of triple engines, having cylinders 24½ in., 38 in., 64 in., by 4 ft. stroke. Morison's Patent Evaporator is fitted, and Weir's automatic feed pumps and heater are also provided. Steam is supplied by two large double-ended boilers, working at 160 lbs. pressure. Throughout the machinery is in excess of the requirements of Lloyd's and the Bureau Veritas. Mr. Romer has superintended the erection of the machinery throughout. The following steamers, engined by Messrs. Richardson, have proceeded to sea after having had successful trial trips. The s.s. *Zampa*, owned by Messrs. Herskind & Woods, of West Hartlepool, on June 5th; the s.s. *George Allen*, owned by James Westoll, Esq., Sunderland, on June 10th. During the month the firm have had numerous enquiries for tripling, and there seems a reasonable prospect of a fair amount of work in this branch. Morison's patent evaporator and feed heater are also much enquired for, and orders continue to flow in from all parts of the country. Messrs. T. Richardson & Sons have long been famed for the quality of their crank and propeller shafting, and for the expedition with which these are turned out in cases of emergency. They are now laying themselves out still more for this class of work, and, as a result, have booked a great number of orders recently for these specialities. The firm have completed a set of triple-expansion engines for the *Lazevago Maskin* and *Jernskibsbyggeri Bergen*, of the following dimensions: cylinders 23 in., 37 in., 61 in. diameter by 42 in. stroke; working pressure, 160 lbs. This is the second set of engines supplied to Bergen within a year.

Stockton.—Shipbuilding at this centre has undergone little change since last month, but whatever alteration may be noted is in the direction of lessened business. Messrs. Blair & Co. are still quite busy in their various departments, and are likely to have a continuance of the briskness for some time to come. Since June 18th the undermentioned steamers engined by the firm have had successful trial trips. The s.s. *Darlington*, built by Messrs. Richardson, Duck & Co., of Stockton, for Messrs. the Commercial Steamship Co., of London, having engines of 200 H.P. nominal, with cylinders 22½ in., 37 in. and 61 in. by 42 in. stroke. The s.s. *Lizzie*, built by Messrs. J. L. Thompson & Sons, Sunderland, for James Gray, Esq., Whitby, having engines of 160 H.P., with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. Both these engines are constructed to work at 160 lbs. pressure of steam, and on their trials were found to work most satisfactorily.

Middlesbro'.—Messrs. Raylton, Dixon & Co. launched a vessel on the 17th inst., and have now some half dozen remaining on the stocks of their two establishments. Messrs. Craggs & Co. also launched a vessel on the 17th, and have now but one on the stocks, which is in the framing stage. Neither of these firms have booked any orders lately. Messrs. Harkess & Sons have been very busy during the month, and have in the time nearly completed two steam trawlers. They are framing a vessel of 2,000 tons, and are carrying out an extensive overhaul of one of the New Zealand Union Steam Shipping Co.'s boats. The firm are also doing a general overhaul to the s.s. *Faith*, of Middlesbro', and are getting three steel barges ready for shipment to Africa. The twin-screw steamer built by the firm for passenger service on the river Plate, has arrived at Buenos-Ayres all right, after an excellent run, and orders for other vessels of a similiar type are expected to soon come to hand.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.

Barrow.—There is a steady business industrially speaking in shipbuilding and engineering, and the works in the district are well employed, with the exception of the Graving Dock Shipping and Engineering Works, which has been closed for several months. There is, however, very great activity at the works of the Naval Construction and Armaments Co., where the work in hand is being pushed forward at a rate which will soon dispose of the orders and necessitate the acceptance of new work. H.M. cruiser *Latona*, which was launched some weeks ago, has received her engines and boilers, and is being equipped with all appliances, with the exception of guns. She will soon be ready for sea. The sister ship *Melampus* will be launched on the 2nd of August, and the third cruiser which is being built at this yard, for her Majesty's Government, to be named *Naiad*, will be put into the water in about two months. The first of the three high-speed steamers of 7,000 tons each, which are being built at Barrow for the Canadian Pacific Railway Co., and intended to be placed on the Pacific station, will be launched on August 28th, and the other two steamers for this service are well advanced in plating and framing. Other new work of an important character is expected at Barrow, although it is reported that the demand is anything but brisk, and certainly there is a tendency on every hand to reduce prices per tonnage. The repair orders which are on hand are of an important character, and they are likely to be supplemented by others which are now being negotiated for. The disposition of the owners of vessels to take out old engines and boilers and supplement triple-expansion engines is gaining ground, and there is much promise of new orders from this quarter.

Workington and Maryport.—There is a steady trade in shipbuilding at these places, but the activity is not so pronounced as it has been.

Whitehaven.—The shipbuilding yard at this place is still closed, and no report is to hand of any probable buyer.

There is a fair enquiry for steel shipbuilding materials in the district, and plates are quoted at £6 15s., and angles at £6 5s. per ton.

THE MERSEY.

THE shipbuilding industry of this district continues to tend steadily in the direction of decreasing activity, and it seems not unlikely, except where English and Foreign Government contracts for warships are being carried out, as in the case of Messrs. Laird & Co., of Birkenhead, that before the close of the present year there will be comparatively little or no work in the hands of shipbuilders on the Mersey. So far as general work is concerned an almost complete absence of inquiries is still reported, and gradually the contracts which for some time past have kept the shipyards so fully employed are being completed with no new orders coming forward to replace the finished vessels as they leave the stocks, and a period of exceptional quietness is being looked forward to. Even if there were inquiries to tender for new work it is more than doubtful whether shipbuilders would be in a position to meet the present views as to the prices at which they ought to be accepted. Some descriptions of shipbuilding material, particularly steel plates, continue, it is true, to decline rapidly in price, and to this extent builders are placed in a more favourable position, but they are still too heavily handicapped on the question of labour to undertake further contracts with the prospect of any remunerative return, and the absolute necessity of a substantial reduction in wages is steadily but surely forcing itself to the front as absolutely essential before any revival from the present slackening off in trade can be [illegible]cted. Any successful movement in this direction [illegible]er, scarcely within the range of possibilty, at any rate during the present year. Although activity in the shipbuilding industry is rapidly running out, there is a considerable amount of constructive work, particularly in connection with railway extensions and other large undertakings either in hand or in prospect, which will continue to give employment to labour, and thus counteract to a considerable extent the decrease of work in shipbuilding. So far even in the shipbuilding yards there is no really appreciable falling off so far as employment for the workmen is concerned, the returns of the trades unions showing no increase in the number of out-of-work members on the books, and the reports of the Amalgamated Society of Engineers and the various districts on the Clyde show that the members of the above society engaged in the shipyards are still fully employed, whilst, taking all the branches of the society throughout the country, the actual out-of-work members are less than 2 per cent. of the total membership, and the Steam-engine Makers Society is only paying donation benefit to about ½ per cent. of its members. These returns are conclusive evidence that the workmen are not yet experiencing as regards employment any effects from the slackening off in activity, and so long as the trade union organisations are not burdened with calls for the support of out-of-work members it is scarcely likely they will listen to any suggestions as to the necessity of reducing wages, even though this should be evident as the only means by which employers can secure new work to keep their establishments going. That some general movement for the reduction of wages is being looked for is, however, being recognised by the men, and the result of the first step in this direction which is being taken on the Clyde is being watched not only with deep interest, but with some anxiety. Some similar step is also in the minds of the shipbuilding firms on the Mersey, although nothing of any really definite character has yet been decided upon. The upward movement in wages which has been going on until even within the last few weeks has, however, now certainly come to an end; there will be no further concessions to the demands of the men, but gradually as work now rapidly approaching completion runs out, workmen will, in all probability, be discharged as the preliminary for bringing wages back to a level more in accordance with the altered conditions of trade.

Messrs. Laird and Co., of Birkenhead, are being kept busy with their various contracts for war-ships, and several torpedo gun-vessels for foreign governments are rapidly approaching completion, whilst they have now made a fair start on the large British line-of-battle ship they have in hand. The *City of Paris* is still lying in the Birkenhead Docks, where she has been got ready by Messrs. Laird & Co., so that she may be taken round to the Clyde as soon as the builders there are prepared to take her in hand for replacing her damaged engines and machinery. The work which the above firm have in hand will keep them, in all probability, well employed ever the ensuing year; but so far as new general work is concerned, they have very little coming to hand. With reference to work which has been recently turned out by Messrs. Laird & Co., it will be interesting to notice briefly, the excellent performances of the twin-screw steamer *Columbia* they have built for the Hamburg American Steamship Co., and which was launched last autumn. For this vessel it is claimed that since she has been running, she has given quite as good if not even better records than the great Atlantic racing steamers, to whose performances so much prominence has been given of late. It may be interesting to repeat just the outlines of the *Columbia's* construction. This vessel is 470 ft. long, 56 ft. beam and 38 ft. 6 in. deep, moulded. When laden she draws 24 ft. of water, and at that draught displaces about 10,000 tons. Notwithstanding her great beam, which renders her an usually stable vessel, her block co-efficient is remarkably small, being about ·55, from which some idea of her exceptionally beautiful lines may be formed; in fact her whole appearance is most graceful and yacht-like. She has a slight raking stem and the usual elliptical stern, and she is built throughout of mild steel. The screws are revolved by two sets of triple-expansion engines, each set capable of developing 6,250 H.P.; the cylinders are 40 in., 66 in. and 101 in. diameter, with a stroke of 56 in. There are nine main steel boilers in three groups of three each, each group, together with it coal supply, being placed in a separate watertight compartment, and the total heating surface is 35,000 square feet with a total grate area of 1,220 square feet, and the working pressure of steam is 150 lbs. per square inch. The steamer has now made seven or eight trips altogether. Her last trip but one out was from Southampton to New York, and was made in 6 days 16 hours, and some odd minutes, which it is claimed is equal to 6 days 1½ hours from Queenstown. This trip was made at an average of 19 knots for the whole distance. Her return trip was somewhat longer in time, but was taken over a longer course, and her average running on the return trip was 19·14 knots for the whole distance, the biggest day's run in each case being over 20 knots per hour. This may be taken as a very favourable comparison with the best records of the most modern of the well-known Atlantic racers, whilst in every other respect the performances of the vessel have been most satisfactory, her engines having been kept running constantly through several voyages without stoppage of any kind whatever.

Messrs. W. H. Potter & Son have during the past month launched from their shipbuilding yard a large iron four-masted barque of the following dimensions:—Length, 300 ft.; breadth, 32 ft.; and depth of hold, 24 ft. 6 in. The vessel has been built to the order of Messrs. Boyes & Ruyter, of Bremen, to take the highest class in both English and North German Lloyd's registers. At the same time she is in several important particulars in excess of their requirements, and one special feature is the introduction of a deck-house amidships. This vessel, which, on leaving the ways, was christened the *Altair*, is the second which Messrs. W. H. Potter & Sons have built for the same owners. Messrs. Thomas Royden & Sons are simply going on completing the vessels in hand, and report no new work of any kind has been received for a considerable time past.

The iron market has shown some improvement during the past month, and prices have moved up slightly, but when any really substantially higher prices have been asked this has tended to check further buying, and it can scarcely be said that any really material advance has been established by actual business Merchants and dealers combine to undersell, and this fact may be taken as an indication that in some quarters at least there is not much belief in the permanency of present prices, but makers who have been strengthening their position by reducing the output seem evidently determined to hold firmly to their present rates. For the leading brands of pig iron which come into this distinct present quotations average about 49s. to 50s. for Lancashire; 50s. to 51s. for the best foundry Derbyshire, with inferior brands obtainable at about 46s. to 47s., and 45s. to 45s. 6d.; for forge Lincolnshire to 47s. and 47s. 6d., for foundry qualities less 2½; 51s. 10d. to 52s. 4d., for good foundry Middlesbro'; and 54s. 6d. for Eglington, net cash delivered equal to Manchester. Hematites have stiffened up slightly in price, not so much owing to increased business as to the gradual reduction in warrant stores, and for special brands particularly, buyers have to pay in some instances a substantial advance upon late rates. Delivered in the Manchester district quotations are now about 63s. 6d. to 64s., less 2½, for good foundry qualities.

In the manufactured iron trade there has been a slightly increased weight of business coming forward, but still the new orders giving out are not of any very great weight, and some of the leading iron works in the district are only very indifferently employed. Prices show no improvement whatever, but if anything for some descriptions have eased down slightly during the month. For delivery equal to Manchester or Liverpool good ordinary bars do not average more than £6 7s. 6d. to £6 10s. per ton, and as low as £6 5s. is reported to have been taken. Sheets on the other hand have shown if anything a little improvement upon the very low figures at which they have recently been quoted; the better qualities of Lancashire sheets are now averaging £7 15s., and some Staffordshire qualities being quoted at £7 17s. 6d. delivered here.

The demand for all descriptions of steel plates continues extremely dull, and prices still tend steadily downwards. Notwithstanding that boiler makers throughout the district are all very busy, they seem to be in most cases well-covered for present requirements, and the only business giving out has been occasional small orders to cover odd boilers here and there, and for these extremely low prices are being quoted. For prompt specification makers are now sellers at as low as £7 17s. 6d. for the best qualities of steel boiler plates, and even at this low figure they in some instances include extras, whilst merchants are willing to take even a less price than this. For steel ship plates quotations have been so irregular during the month that it is difficult to get at anything like a fixed price; in fact, if there were orders of any weight in the market (which, unfortunately there are not) it is doubtful at what price they could be placed. Certainly there would be no difficulty in finding makers ready to accept orders at under £7 per ton for delivery ex-steamer Liverpool; but there has been really nothing doing to actually test prices.

In the metal market there has been no further change in prices since the advance upon list rates quoted last month. This advance has tended to check further buying, and the business put through has been only very small in weight, but manufacturers having sufficient orders on their books to keep them well engaged, at any rate for the present, are showing no disposition to force business by offering any inducement to buyers by concessions on their list rates. Consequently prices remain very firm at the full rates.

In the timber trade imports of most articles have again been moderate, and although the deliveries have generally been satisfactory a great want of confidence still exists; values, however, have with few exceptions been fairly maintained. The aggregate import for the first half of the year is less than last year, and although the deliveries are considerably in excess the general state of the trade would still render it necessary that imports should continue on a limited scale.

The coal trade, so far as shipping is concerned, has been only very quiet for the greater portion of the past month, but with the close has shown some improvement, no doubt buyers having come to the conclusion that it is advisable to place out orders before any upward movement in prices takes place, following upon the concession of a further advance of 5 per cent. in colliers' wages. The leading firms in the Manchester district are advancing their list rates 5d. per ton, and generally there is a tendency to harden, although no very material upward movement is scarcely probable just at present. For delivery at the High Level, Liverpool, or the Caiston Docks, ordinary qualities of steam coal have been readily obtainable at 9s. 6d., or even a little less per ton, but a slight hardening upon this figure has taken place with the close of the month, and quotations may be said to average about 9s. 9d. per ton.

WELSH NOTES.

SINCE our last number the investor has been asked to find the necessary money to construct a new railway between the Llynvi and Ogmore coal districts and Barry, but without the expected success. The new line was referred to in these pages at the time the Parliamentary powers were secured, some twelve months since, and the route of the line fully described. That the public should not have come forward more readily seems somewhat strange, for the new company had the elements of success about it. It is by no means improbable, however, that the line will yet be made; it is certainly needed by the owners of coal property in the districts named, who now have to depend upon the tender mercies of the Great Western Railway, and they who have had experience of this company where it has no opposition will fully understand what this means.

The new line connecting Swansea with the Rhondda Valley has at length been opened, and the people who show the least delight are the Swansea men themselves. One might think from the attitude adopted by some of them that they had no need at all for the high class coal they can now ship as cheaply as the Cardiff merchants. There are some of them, however, who are fully alive to the advantages of the new line, and before long we shall no doubt see quite a quantity of coal going over the line to the western port.

The Barry Co. has completed its first year and the work done is eminently satisfactory. The estimated 3,000,000 tons of coal shipments was not reached by about 400,000 tons, but it is to be remembered that at the beginning of the company's career the dock was not in full working order. That the estimates of the promoters of the concern were not over sanguine is, however, proved by the fact that the shipments for June were at the rate of 4,000,000 tons per annum. The success attending this enterprise has naturally had the effect of sending up the price of the company's stock. The £100 shares are now standing at £197, which is rather better than Taff Vales were in their palmy days.

By the way we see that the Barry directors are at last going to construct a commercial dry dock. The dock is apparently to be of very ample dimensions. It would have looked better, however, had this dock been constructed at the outset.

Once more there are rumours about Milford Haven! The port is to be taken in hand by the North Canadian and Atlantic Steamship Co. A local daily in referring to this, says that "it is expected that the construction of the deep water pier and the dry dock will be energetically pushed forward, and accommodation thus provided for the steamers of the new company!" We were always given to understand that if there was one thing more than another for which Milford was to be commended it was its deep water, and now behold a deep pier is necessary. How unfortunate that there should be so much cry and such very little wool about this concern.

We referred some time since to an attempt being made by Messrs. Fowler & Co., of Westminster, to form a ring in the anthracite coal trade. The negotiations fell through, but they have since been taken up by a Swansea solicitor, and there now appears to be some chance of the deal coming through all right. The chief objectors to it are the owners of the Onllwyn and Maesymarchog collieries. The basis of the arrangement is that each vendor shall send to the solicitor who has the negotiations in hand the price he will accept; the solicitor on the part of the purchasers will appoint a valuer to agree to the amount with the vendors; at least two-thirds of the anthracite owners must join the ring; that the purchase consideration will be as to one half cash, and as to the other half in fully paid preference or ordinary shares or debentures; and, lastly, that if the scheme be not carried through by August the eighth then the negotiations are to be considered as at an end. We should think the bulk of the owners interested will be highly delighted to get rid of their properties on such terms as these.

By the death of Mr. David Davies, of the Ocean Coal Co., the South Wales coal trade has lost one of its most important members, and the Barry Dock a most fervent supporter. It is perhaps not generally known that Mr. Davies was not all his life connected with the coal trade—that he took it up when he had already made a not inconsiderable fortune as a contractor.

The chief firm engaged in the transatlantic trade from Swansea is the Atlantic Transport Line, of which Messrs. Williams, Torrey & Feild are the managers in this country. The line has been carried on for some time in a quiet sort of way, but now some important changes are being made. The steamers are being increased in size, and it is stated that in future the sailings will be weekly. The chief cargoes carried from Swansea are tinplates, and should the weekly sailings referred to actually be arranged, the Swansea Harbour authorities will have to increase the accommodation for shipping the plates. At present there are only two loading berths; these will have to be increased, and we should think that longer berths will also be necessary. There is no doubt though that whatever is necessary will be done by the Harbour Trust. The next thing is the establishment of an inward American trade, and we understand that Mr. Dixon, Harbour Superintendent, is doing all he can to bring this about.

We understand that within the next few days the new dredging arrangements at Swansea Harbour will be in full swing. As we have already explained the system is Mr. Tydeman's, which has been so successfully used at the Tilbury Dock. At the latter place the cost of dredging was reduced from £1,200 per week to £27. At Swansea the cost of this work has been £125 weekly, so that if a saving be effected there in proportion to that at Tilbury, the trustees will have cause to thank Mr Tydeman.

At the time of writing coal prices at Cardiff are rather firmer, firmer indeed than they have been for some time. The outward freight market, however, remains in a wretched condition. As little as 7s. has been accepted for Malta with full terms and bunkers at 15s. 9d. What common sense there can be in owners accepting such a miserable rate as this it is difficult to see. It is surely about time that shareholders made their voices heard again. In the iron trade, however, as in the coal trade, things are firmer.

On July 24th at a meeting of the Taff Vale directors, it was resolved that a dividend of 3 per cent. per annum be declared on the divided stock. This is equal to 7½ per cent. on the original stock. Nearly all the men on the Taff, Rhymney, and Barry lines handed in their notices yesterday to terminate contracts on August 6. A strike, it is said, is almost inevitable, and should it take place the trade of South Wales will be paralyzed for a time.

At a meeting of the directors of the Barry Docks and Railway Co., held at Cardiff on 25th July, it was decided to recommend the declaration of a dividend of 10 per cent., to place £5,000 to the reserve, and to carry forward £2,400.

BELFAST TRADE NOTES.

THE pier at Redbay, Cushendall, Co. Antrim, which is a busy place for the shipment of iron ore, and the landing of coal and other supplies for that neighbourhood, is now being extended seawards an additional 60 ft., the contract for which has been entrusted to Messrs. Paul Rodgers & Co., Carrickfergus.

The iron screw tug, *William Thompson*, of Belfast, built at Dordt in 1875, of the following dimensions: Length, 64 ft. by 15 ft. by 8 ft., engines, 30 N.H.P., has been sold by her owner, Captain Richard McGreevy, for £730.

The *Star of Denmark*, of Belfast, one of the fine line owned by Messrs. J. P. Corry & Co., Belfast, and known as the Star Line, and built of iron by Messrs. Harland & Wolff, Belfast, has been sold to Messrs. Hine Bros., of Maryport, and will henceforth be known as the *Denton Holme*, of Maryport. She is 998 tons register, and deadweight carrying capacity of 1,550 tons.

Messrs. Harland & Wolff, and Messrs. Workman, Clark & Co., have secured large lots of newly made ground from the Harbour Commissioners for the extension of their engineering works, and the latter firm has also obtained a new site for a shipbuilding yard.

Shipbuilders continue well supplied with work, and several vessels are ready for launching. The men are now working steadily after the holidays, and for the present there is no talk of a reduction in wages. The supply of skilled workmen is, however, getting much easier. Engineers and boilermakers are fairly busy, and there is a full staff of hands employed in all the shops.

LEITH NOTES.

THE shipbuilding and engineering trades here have a slightly brisker aspect this month, and one or two new orders have been received, in addition to a large amount of repair work. Messrs. Ramage & Ferguson have received the order to build a four-masted steel sailing ship of 2,700 tons register for Messrs. Gardiner & Co., of Liverpool.

Messrs. Hawthorns & Co. have been successful in receiving the order for a twin-screw steamer for the use of the Submarine Mining Corps, her dimensions being 80 ft. long, 18 ft. broad by 9 ft. 3 in. deep, propelled by two sets of engines, having cylinders 11 in. and 22 in. by 15 in. stroke. This firm have also got orders to build two steel lighters to the order of Messrs. Donald Currie & Co., London, to be shipped in pieces to Cape Colony.

The trawling industry in Aberdeen has increased very much of late. Eight years ago, when the trade commenced, the supply of fish landed by line and trawl boats was under the value of £10,000. The supply landed in the past six months from January to June has been 76,044 cwts. of fish of the value of £59,774, showing, compared with the returns for the same period last year, an increase of £20,000. Two new trawlers were launched on the 16th by Messrs. Hall, Russell & Co., Aberdeen, for Mr. Wm. Pyper, of Hillhead, a large owner of this class of vessel.

The National Federation of Shipbuilders held their annual meeting in the Royal Hotel, Edinburgh, on the 10th ult., and dined together in the evening, forty members being present.

The Institute of Electrical Engineers held their annual meeting in the Grand Hall of the Edinburgh International Exhibition on the 16th, 17th, and 18th ults., when several interesting papers were read. On the 17th the members visited the Forth Bridge, and on the 18th Merchiston Castle, the birthplace of Napier of Merchiston, the inventor of logarithms.

Arrangements have been completed for the construction of two new landing-stages in the Forth, one at Charleston and the other at Elie. Mr. Chalmers, Burntisland, is the contractor, and Mr. R. M. Cameron, Edinburgh, is the engineer.

Dr. A. C. Elliott, D.Sc., C.E., who for the past five years has been Professor Armstrong's assistant in the Department of Engineering in the University of Edinburgh, has been unanimously appointed by the Council of the University College of South Wales, Cardiff, to the chair of Engineering. Of the forty candidates for the post, two were selected, both being Edinburgh men, Dr. Elliott being the successful one.

Some gloom has been cast over engineering circles here during the month by the death at his residence, Rainesfield, Leith, of Mr. Stewart Robertson, for a number of years manager in the firm of Messrs. S. & H. Morton & Co., Leith. Mr. Robertson was held in high esteem by all who knew him, both for his thorough ability as an engineer and for his unassuming manners.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Grand Duke Constantine.—On June 21st Messrs. R. & W. Hawthorne, Leslie, and Co., Limited, launched a steel screw steamer from their yard at Hebburn-on-Tyne. She is built for the Russian Steam Navigation and Trading Co., of Odessa, for their passenger service in the Black Sea. Her principal dimensions are 284 ft. by 37 ft. by 28 ft., with clipper stem and figurehead. The vessel was named the *Grand Duke Constantine*.

Chamois.—On June 21st there was launched from the ship building yard of Messrs. John Priestman & Co., Southwick, Sunderland, a steel screw steamer, built to the order of Messrs. Jackson Bros. & Co., of London, of the following dimensions: Length, 275 ft.; extreme breadth, 39 ft.; depth (moulded), 21 ft. 3 in. The engines, which are being supplied by Messrs. Westgarth, English & Co., Middlesbrough, are 1,000 I.H.P. The ship was named the *Chamois*.

Calcutta City.—On Wednesday, July 2nd, Messrs. Edward Withy & Co. launched from their yard at Hartlepool the large steel screw steamer *Calcutta City*, built to the order of C. Furness, Esq., of West Hartlepool. The vessel is over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge-house, and a topgallant forecastle. All decks, deck erections, skylights, bulwarks, bulkheads, grain divisions, &c., are constructed of steel and iron. Cellular bottom for water ballast, all fore and aft. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels executed in a very elegant and effective style by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, and will be fitted with triple-expansion engines by Messrs. T. Richardson & Son, Hartlepool. On leaving the ways the vessel was gracefully christened *Calcutta City* by Mrs. C. Furness.

Patapsco.—On July 3rd a steel schooner-rigged steamer, of about 2,700 tons, was launched at Sunderland; owned by the Neptune Steam Navigation Co., Limited, Sunderland.

Oswald.—On July 3rd Messrs. T. Turnbull and Sons launched from their premises, Whitehall, Whitby, a new screw steamer. She was named *Oswald*, and is of the following dimensions:—Length over all, 268 ft. 9 in.; length between perpendiculars, 258 ft.; breadth, 37 ft.; depth to ordinary floors, 18 ft. 1 in. Her engines, which are 172 H.P., are by Messrs. Blair & Co., Stockton-on-Tees, and patent windlass by Emerson, Walker & Co.

Loch Maree.—On July 3rd there was launched from Messrs. Palmer & Co.'s Jarrow yard a fine steel screw steamer, called the *Loch Maree*. The dimensions of the vessel are as follows:—Length between perpendiculars, 312 ft; breadth (moulded), 40 ft.; depth, 27 ft. 6 in. The vessel will be rigged as a two-masted schooner, and has been built under special survey to class 100 A1 at Lloyd's. She is of the three-deck type. Accommodation will be provided for a few passengers. Water ballast is provided for in a double bottom on the cellular system. The vessel has been built for the Loch Line Steam Shipping Co., of Dundee.

Sola.—On July 3rd Messrs. Sir Raylton Dixon & Co. launched from their Cleveland Dockyard a steel screw steamer, which has been built to the order of Messrs. Arthur Holland & Co., London. The leading dimensions of the vessel are:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a deadweight carrying capacity of 3,300 tons. She is built with poop, raised quarter-deck, long bridge, and topgallant forecastle. Her engines, which are being supplied by Messrs. the North-Eastern Marine Engineering Co., Sunderland, are of 180 N.H.P., with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. On leaving the ways she was christened *Sola*. This is the fifth vessel launched for her owners within the last three months by this firm.

Charles T. Jones.—On July 3rd there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a screw steamer, named the *Charles T. Jones*, which has been built to the order of Messrs. Jones & Thomas, of Cardiff. The following are the dimensions of the vessel:—Length, 290 ft.; breadth, 40 ft.; depth (moulded), 22 ft. 6 in. The vessel is of the improved well-deck type, fitted to meet the requirements of the Grain Cargoes Act, and classed 100 A1 at Lloyd's under special survey. The engines are on the triple-expansion system, having cylinders of 23 in., 37½ in. and 61½ ins. diameter, and 39 in. stroke. The engines and boilers have also been built by Messrs. Readhead & Sons. The vessel was named by Mrs. Harry Jones, wife of one of the managing owners.

Madrileno.—On July 3rd there was successfully launched by Messrs. Robert Thompson & Sons, from their Southwick Yard, Sunderland, a steel screw steamer, built to the order of Senor M. M. de Arrolegui, of Bermeo, Spain. The following are the vessel's dimensions and length, over all, 332 ft.; breadth, 42 ft.; and depth of hold to Lloyd's floors, 28 ft. 9 in. She has been built under special survey to class 100 A1 at Lloyd's, under the spar deck rule, and has cellular double-bottom, fore and aft, for water ballast, six bulkheads, four large hatchways with double derricks to each, patent freeing ports in bulwark, lighthouses on forecastle, four horizontal steam winches, and large donkey boiler, direct acting steam capstan windlass, combined steam and hand-steering gear, and all the latest improvements, has large house on deck for accommodation of captain and officers, and a few passengers; the engineers and petty officers being accommodated in bridge amidships, and sailors and firemen in topgallant forecastle. The engines, by Messrs. George Clark, Limited, Southwick Engine Works, have cylinders 24½ in., 40 in., and 66 in., with 45 in. stroke, with two large double-ended boilers, 13 ft. and 15 ft. 6 in., working pressure 160 lbs. On leaving the ways she was gracefully christened *Madrileno* by Miss Goodman, of Cambridge.

Bristol.—On July 3rd Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length over all, 300 ft.; breadth, 38 ft.; depth, 22 ft. 2 in.; built to the order of Messrs. Mark Whitwill & Son, Bristol. She will class 100 A1 at Lloyd's, and has large internal and deadweight capacities. Her deck erections consist of a poop, raised quarter-deck, long bridge of extra strength, and open topgallant forecastle. A handsome saloon and state rooms for the captain, officers, and a few passengers, will be fitted up aft, the engineers' rooms will be in the after part of the bridge, and the crew's berths in the fore part of same. The hull is built on the web-frame system, and gives clear holds for stowing cargo of the bulkiest description. Large hatchways are fitted, four steam winches, steam steering gear amidships, and screw gear aft, Emerson, Walker & Co.'s, patent windlass, large donkey boiler, and double bottom under each hold for water ballast. The boats will be carried on beams overhead, and the vessel in every respect thoroughly equipped for general trading. First-class engines on the three-cylinder triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, working on three cranks; they will develop over 950 H.P. The cylinders are 21½ in., 35 in. and 58 in. diameter, with a piston stroke of 39 in., and a constant supply of steam at a working pressure of 150 lbs. per square inch will be maintained by five large steel boilers. The vessel was gracefully christened *Bristol* by Miss M. Davies, Llangennech, South Wales.

Penwith.—On July 3rd there was launched from the shipbuilding yard of Messrs. Harvey & Co., Limited, Hayle, Cornwall, a large steel screw steamer of the modern well deck type, built to the order of R. B. Chellew, Esq. The vessel is of the following dimensions:—Length, over all, 279 ft. 5 in.; beam, extreme, 36 ft. 9 in.; depth, moulded, 21 ft. 2 in.; with a deadweight capacity of about 2,900 tons. She is built on the web-frame principle, having poop containing saloon with captain's and officers' cabins and mess-room, long raised quarter-deck, and bridge of extra strength, with engineers' accommodation at after end of same, and close to engine room; crew berthed at fore end of same; a short well forward and also top-gallant forecastle, and is built under Lloyd's special survey to class 100 A 1. This steamer has water ballast right fore and aft on the cellular system, and is fitted with all modern improvements for the rapid loading and discharging of cargo, including large donkey boiler and four double-cylindered steam winches, and has direct-acting steam windlass, steam steering gear by Messrs. J. Rogers & Co., and Robertson & Co.'s patent screw gear aft, with a gross tonnage of about 2,000 tons. The engines and boilers are also made by Messrs. Harvey & Co., and comprise all the latest improvements for securing economy in the consumption of fuel. The engines are on the tri-compound surface-condensing principle, with cylinders 21½ in., 33 in., and 56 in. diameter, and 39 in. stroke. The starting and reversing gear is so arranged that it can be worked by either hand or steam, and the starting engine can also be used when overhauling for turning the main engines. Steam will be supplied from two small boilers, each 13 ft. 6 in. diameter by 10 ft. long, fitted with Purvis's patent ribbed flues, and constructed to Lloyd's requirements for a working pressure of 160 lbs. per square inch. A large quadruple-acting steam ballast pump is provided for pumping out the water ballast tanks, and a double cylinder high pressure boiler feed pump, both of Cameron's make. The ship and machinery during construction have been surpervised by Mr. J. Williams, the owner's superintendent engineer.

Alleghany.—On July 4th Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding yard, Stockton-on Tees, the largest vessel that they have as yet built. Her dimensions are:—328 ft. 8 in. by 42 ft. by 28 ft. depth, moulded to spar decks. The vessel has been built to the order of John S. Barwick, Esq., of Sunderland, and has been designed and constructed by the builders for the purpose of carrying oil in bulk, of which she will carry over 4,000 tons. She is divided into 15 compartments, and is fitted with cofferdams to promote safety. Her bunkers are also arranged to carry oil as fuel, and she is built to the highest class in Lloyd's, under special survey. She is rigged as a three-masted schooner, and will be fitted with Pepper's patent steam steering gear; Emerson, Walker & Thompson Bros.' steam windlass, and outfit of winches by Robert Roger & Co., steam cooking apparatus by Grieve & Gillespie. The engines are supplied by John Dickinson, Esq., of Palmer's Hill Engine Works, Sunderland. The cylinders are 25 in., 40 in., and 66 in. by 45 in. stroke. The boilers are of Siemens-Martin steel, double-ended with large heating surface; working pressure, 150 lbs. per square inch. The engines are designed so as to embrace the latest improvements in marine engineering. The vessel is constructed according to the builder's latest arrangements, which permit of her being readily altered into an ordinary cargo vessel. A very powerful and complete installation of electric light has been supplied; also oil pumps, which are of a very special character, by Hayward, Tyler & Co., engineers, London. Her tanks have all been tested on the stocks, and passed by Lloyd's surveyor and Mr. Joseph D. Bissett, the owner's representative. This is the fourth vessel that Messrs. Craig, Taylor & Co. have built for this special trade. As the vessel left the ways she was gracefully christened the *Alleghany* by Miss Taylor, daughter of Thomas Taylor, Esq., J.P., Oakwall Hall, near Leeds.

Culmore.—On July 5th the *Culmore*, a screw steamer of 1,000 tons, was launched from the building yard of Messrs. John Jones & Sons, Brunswick Dock, Liverpool. The engines will be of the triple-expansion type. She is fitted with Emerson & Walker's patent direct steam windlass.

Cape Breton.—On July 5th Messrs. Osbourne, Graham & Co., Hylton, near Sunderland, launched the screw steamer *Cape Breton*, built to the order of the Black Diamond Steamship Co., Limited, of Montreal. The vessel is 258 ft. by 37 ft. by 19 ft. 2 in. depth, moulded. She will take Lloyd's 100 A1 class, and will be fitted with tri-compound engines of 160 H.P. by the North-Eastern Marine Engineering Co., of Wallsend. The vessel was named by Miss W. Graham, of Hylton. She is fitted with Emerson & Walker's patent direct steam windlass.

Altair.—On July 5th Messrs. W. H. Potter & Sons launched from their shipbuilding yard, Queen's Dock, Liverpool, a large four-masted iron sailing ship of the following dimensions:—Length, 300 ft.; breadth, 42 ft.; depth of hold, 24 ft. 6 in. The vessel has been built to the order of Messrs. Boyes & Ruyter, of Bremen, to take the highest class in both the English and North German Lloyd's Registers, and, at the same time, she is in several important particulars in excess of their requirements. The vessel will be rigged as a four-masted barque, with skysails on the fore and main masts, and is fitted with steam capstan windlass and two steam winches. This is the second vessel that Messrs. W. H. Potter & Sons have built for the same owners. As the vessel was leaving the ways she was christened the *Altair* by Mrs. E. H. Bushell.

Plassy.—On Saturday, July 5th, there was launched from the Elswick shipyard, Newcastle, a gunboat, built by Messrs. Armstrong, Mitchell & Co. to the order of the Indian Government. Amongst those present were Sir Peter Lumsden, Lady Lumsden, Capt. Noble, Col. Dyer, Mr. P. Watts, Mr. Hole, R.N., Capt. Hamilton, R.N., Mr. John Black (Admiralty surveyor), Mr. S. Dean (Admiralty surveyor, of her Majesty's ship *Plassy*), and Col. Madson and Capt. Raaby, of the Danish Artillery. As the vessel glided into the river she was named the *Plassy* by Lady Lumsden. Capt. Noble said the main features of the vessel were:—Length, 230 ft.; breadth, 27 ft.; mean draught, 8 ft. 3 in.; displacement, 735 tons; I.H.P. with forced draught, 4,500; and estimated speed 21 knots. Her armament would consist of two 12-centimètre quick-firing guns, four 3-pounder quick-firing guns, and five torpedo guns. She had been named the *Plassy*, and he ventured to think a better name could hardly have been chosen for a vessel intended for the defence of our Indian Empire, for it recalled the first great triumph in the long career of success that had distinguished the Indian Government. Lord Cross had requested Lady Lumsden to name the vessel.

H. M. Pollock.—On July 5th this fine vessel was successfully launched from the shipbuilding yard of Messrs. Wm. Doxford & Sons, at Pallion, Sunderland. It has been built to the order of the Steam Navigation Co. of Ireland, Limited, of Belfast (Wm. C. Mitchell, Esq., J.P., chairman), entirely of steel, under special survey to the highest class at Lloyd's, and to carry a large cargo on a light draught of water. The steamer is of convenient dimensions, has been furnished with latest improvements in hull. Engines and machinery by Messrs. Wm. Doxford & Sons, under the special specifications and personal superintendence of Mr. Alex. Taylor, of Newcastle-upon-Tyne, the engineer to the company, of which Messrs. John Burke & Co are the managers. The engines, which are constructed in every detail on the latest principle, are of extra size and power, and are supplied with high-pressure steam from very large boilers. This is the second steamship built for the same owners by Messrs. Wm. Doxford & Sons, who are well known as long-established shipbuilders of standing and reliability. This vessel is expected to be ready towards the end of July, when the good steamer will leave for sea, under the command of Captain Wm. Gibson. The steamer has been fixed for remunerative employment for some time to come. The christening ceremony was gracefully performed by Mrs. H. M. Pollock, of Wellington Park, Belfast, in the presence of a large number of friends from Belfast, and from the East Coast of England.

Volo.—On July 7th Earle's Shipbuilding and Engineering Co., Limited, launched from their yard, at Hull, a fine screw steamer, named the *Volo*, which they have built for Messrs. Thomas Wilson, Sons & Co., of the same town, to the following dimensions:—Length, 260 ft.; breadth, 32 ft.; depth of hold, 16 ft. 6 in. She is arranged with long full poop and topgallant forecastle, and accommodation is provided aft under the poop for twelve first-class passengers, with dining saloon, smoke-room, chart-room, &c., all fitted up in polished wood in a good substantial manner; the remainder of the 'tween decks is adapted for the conveyance of emigrants. The officers' quarters are on the poop amidships, and those of the crew are in the forecastle; water ballast is provided for in the engine and boiler space and fore and after peaks. The ship is schooner-rigged, with pole masts; she has steam steering gear fitted amidships, and hand screw gear aft, good cargo capacity, combined with fine lines for speed, and she has efficient appliances for the rapid working of the cargo. After launching, the vessel was towed round to the Albert Dock to receive her machinery, which is on the triple-expansion principle, and has been made by Messrs. Amos & Smith, of Hull.

Gepfton Butte.—On July 15th Messrs. Edwards & Symes launched from their yard, Millwall, London, a steel twin-screw cargo steamer of the following dimensions:—Length, 180 ft.; breadth (extreme), 28 ft.; and 7 ft. 6 in. deep; and fitted by the builders with compound surface condensing engines, having cylinders 12 in. and 24 in. diameter, with a stroke of 16 in.; and two steel boilers, constructed for a working pressure of 100 lbs. per square inch. She has been built to carry 500 tons of cargo on 5 ft. draught of water, and as the vessel was leaving the ways was gracefully christened the *Gepfton Butte* by Miss E. C. Symes, daughter of one of the partners.

Benington.—On July 16th the first iron vessel built in the yard of Messrs. J. P. Rennoldson & Sons, South Shields, was launched and christened the *Benington*. The vessel has been built to the order of the Boston Deep Sea Fishing Co., Limited, and is intended for the deep sea trawling. Her dimensions are 90 ft. in length, 20 ft. 3 in. in breadth, and 10 ft. 9 in. depth of mould. Her engines are compound surface condensing, cylinders 15 and 29 in. in diameter, with a 21 in. stroke.

Sam Handford.—On July 17th there was launched by Messrs. R. Craggs & Sons, at Middlesbrough, a steel screw steamer of the following dimensions:—Length, 270 ft.; breadth, 36 ft. 8 in.; depth, 19 ft. 0½ in. She will be fitted with triple-expansion engines by Messrs. Westgarth, English & Co., of the same port, having cylinders 20 in., 33 in., and 54 in. by 36 in. stroke. The vessel was named the *Sam Handford*.

Weybridge.—On July 17th Messrs. Sir Raylton Dixon & Co. launched from their Cleveland dockyard a steel screw steamer, which has been built to the order of Messrs. J. Temperley & Co., of Newcastle and London, for the Temperley Steam Shipping Co. This vessel is built on the web-frame principle, with poop, raised quarter-deck, and partial awning-deck, her chief dimensions being—Length over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight carrying capacity of about 3,600 tons. Her engines will be supplied by Mr. John Dickinson, Sunderland, of 190 N.H.P., with cylinders 22 in., 35 in., 59 in. by 39 in. stroke. On leaving the ways the vessel was christened *Weybridge* by Miss Keith Glen, Lincluden, Greenock.

Hangesund.—On July 17th there was launched from the shipbuilding establishment of Messrs. W. Harkess & Son, at Middlesborough, a finely-modelled steel screw steamer, built to the order of Mr. Carl Foss, of Hangesund, Norway. Her principal dimensions are—Length, 190 ft.; breadth, 28 ft., and depth, 14 ft. 9 in. She is of the long raised quarter-deck type, with bridge and top-gallant forecastle, all her decks being of pinewood. She is fitted throughout with web frames, and has water ballast under holds in peak. The engines, which are to be placed on board in Dundee, are triple-expansion surface-condensing, by Messrs. Gourlay Bros. & Co., of that town, and will indicate 500 H.P. The vessel is intended for the American coasting trade, and on her return from Dundee will receive her complement of fittings and outfit, which are on a liberal scale. On leaving the ways she was named *Hangesund*, the christening ceremony being performed by Mrs. Grant Barclay, of Coatham.

Scharlachberger.—On July 17th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, the ninth steamer built by that firm for the Hansa Steamship Co., of Bremen. The length of the vessel is 323 ft.; breadth, 41 ft.; and depth of hold, 27 ft. 6 in. The steamer is built to the spar deck rule, and has large top-gallant forecastle to accommodate crew and firemen, and long bridge amidships, under which is placed the saloon and accommodation for captain, officers, and a few first-class passengers. The vessel is constructed upon the web-frame principle, thus dispensing with hold beams, and has cellular water ballast all fore and aft. All weather decks are of wood, and all frames of Z steel. Her class will be 100 A1 Lloyd's special survey, and also the highest class in the German Registry. The deck machinery consists of five large steam winches, Donkin & Nichol's steam steering gear, which is placed in the engine-room and worked from the bridge; Harfield's patent direct steam windlass; Tyzack's patent anchors, and all the usual appliances for handling cargo and working the ship with the greatest possible despatch. The main engines are upon the tri-compound principle, by the North Eastern Marine Engineering Co., Limited, Sunderland, and have cylinders 23½ in., 37 in., and 64 in. by 42 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square in. The vessel, during construction, has been inspected on behalf of the owners by Mr. Wulff and Mr. Himer, and upon leaving the ways was gracefully named *Scharlachberger* by Miss Ritschard, of Hamburg, after which she was towed into South Dock to receive her machinery.

Manchester.—On July 18th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, built to the order of Messrs. Evan, Thomas, Radcliffe & Co., Cardiff. The vessel will take Lloyd's highest class. Her dimensions are:—Length, overall, 285 ft.; breadth, 37 ft. 2 in.; depth, 21 ft. 10 in. The deck erections consist of a poop, raised quarter deck, long bridge, and top-gallant forecastle. The saloon and cabins are aft, the engineers' rooms amidships, and the crew's accommodation in the fore-part of the bridge. The hull is built on the web-frame system. Large hatchways are fitted, four steam winches, steam steering gear amidships, screw gear aft, two donkey boilers, and direct steam patent windlass, boats on beams overhead, two masts with fore-and-aft rig, and all modern working appliances will be fitted for general trading. The Central Marine Engine Works of the builders supply fine triple-expansion engines, having cylinders 21½ in., 34 in., and 57 in. diameter, with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The ship was gracefully christened *Manchester* by Miss Winifred Payne Gallwey, daughter of Sir Wm. Payne Gallwey, Thirkleby Park, Bedale.

Halifax City.—On Friday, July 18th, Messrs. Edward Withy & Co. launched from their yard at Hartlepool the large steel screw steamer *Halifax City*, built to the order of C. Furness, Esq., of West Hartlepool. The vessel is over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge-house, and a topgallant forecastle. All decks, deck erections, skylights, bulwarks, bulkheads, grain divisions, &c., are constructed of steel and iron. Cellular bottom, fitted fore and aft for water ballast. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin are handsomely finished in polished hardwood, with painted panels executed in oils by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner with iron pole masts, and will be fitted with triple-expansion engines by Messrs. W. Gray & Co., Central Marine Engine Works, West Hartlepool.

Lynton.—On July 19th the steel screw steamer *Lynton* was launched from the yard of Messrs. John Blumer & Co., at Sunderland. The vessel has been built to the order of Messrs. John Holman & Sons, London, and is of the following dimensions:—Length, between perpendiculars, 250 ft.; beam, 35 ft.; depth, 19 ft. 4 in.

Highland Prince.—On July 19th a well-decked steel screw steamer, built for the Prince Steam Shipping Co., was launched from the yard of Messrs. Short Brothers, at Pallion. She was named the *Highland Prince*. She is to be fitted with engines by Messrs. G. Clark, Limited, on the quadruple-expansion principle, of 200 H.P.

————On July 19th Messrs. T. & W. Smith launched at North Shields a steel screw steamer of the following dimensions:—Length, 229 ft.; breadth, 32 ft. 6 in.; depth of hold, 16 ft. 2 in.; depth, moulded, 17 ft. 1½ in. She will be fitted with triple-expansion engines by the North-Eastern Marine Engineering Co., Limited.

Danby.—On July 19th Messrs. Ropner & Son launched at Stockton a steel screw steamer, built to the order of Messrs. J. Merryweather & Co., of West Hartlepool. Her dimensions are as follows, viz.:—Length, over all, 282 ft. 6 in.; breadth, 38 ft. 10 in.; depth, moulded, 21 ft. 11 in. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 900 I.H.P., and two large steel boilers, working at 160 lbs. The vessel was christened the *Danby*.

Tripoli.—On July 19th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer built to the order of E. C. Thin, Esq., of Liverpool, and of the following dimensions, viz.: length, 300 ft.; breadth, 41 ft.; depth, 22 ft. 2 in.; and to class 100 A1 at Lloyd's on the partial awning deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including four double-cylindered steam winches, direct-acting steam windlass, large donkey boiler, steam stearing gear by Messrs. Muir & Caldwell, and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. The Wallsend Slipway and Engineering Co., Limited, are of the triple-expansion type, having cylinders 23 in., 38 in., and 61 in. by 42 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was gracefully named the *Tripoli* by Miss Irwin, of Sunderland.

Enskar.—On July 19th Messrs. Wigham, Richardson & Co. launched from their Neptune Shipyard, Newcastle-on-Tyne, a finely-modelled steel screw steamer, being the ninth vessel built by this firm to the order of Messrs. George Tweedy & Co., of London. The vessel is built to class 100 A1 at Lloyd's special survey, on the spar deck rule. She will carry 6,000 tons measurement of cargo, besides 300 tons of coal in the bunkers, she has also about 1,000 tons of water ballast placed in deep tanks, available for cargo or bunkers, and under tunnel according to Christie's patent, as well as under the engine-room. In the 'tween decks sidelights are fitted, so that emigrants may be carried. There are also shifting boards for grain, and a very complete set of machinery for working both the ship and the cargo, including steam windlass, steam steering gear, steam winches, &c. Her masts are arranged to suit the Manchester Ship Canal. The engines are of Messrs. Wigham, Richardson & Co.'s own make, and are on their patent four-crank quadruple-expansion type (Tweedy's patent), and are also fitted with the most modern appliances for supplying distilled water to the boilers. The builders are so much encouraged by the entirely favourable reports of the sister ship, the *Fonar*, which is the first steamer engined on the four-crank quadruple system, that they feel convinced that the triplex system will be unable to compete with the greater economy attained by this new type of engine. The *Enskar* was christened by Mrs. Edward Ecroyd, of Edgend, near Burnley.

Phœbe.—On July 1st Lady Dowell launched the *Phœbe*, twin-screw protected cruiser, at Devonport Dockyard in the presence of about 3,000 spectators. The *Phœbe* is of the *Pandora* type, the *Philomel*, building at Devonport, the *Pallas*, building at Portsmouth, and the *Pearl*, building at Pembroke, being sister ships. Five vessels of the same class are building at Newcastle-on-Tyne and Glasgow for the Australian Government. The *Pandora* class of vessels, designed by Mr. W. H. White, Assistant Controller of the Navy, are identical in construction and armament. They are 265 ft. long, 41 ft. broad, with a displacement of 2,575 tons. The engines of the *Phœbe* have been constructed at Devonport, and possess the latest improvements. They are of 7,500 H.P., and with the forced draught should realise a speed of 19 knots. The *Phœbe's* armament consists of eight 47 in. and eight 3-pounder quick-firing guns, one 7-pounder, four ·45 in. five-barrel Nordenfeldts, and 12 14 in. Whitehead torpedoes. She has a coal-carrying capacity of 300 tons, enabling her to steam a distance of 6,000 knots at 10 knots.

LAUNCHES—Scotch.

Lavinia.—On July 2nd there was launched from the yard of the Ailsa Shipbuilding Co. a steel screw steamer, 142 ft. by 25 ft. 6 in. by 12 ft. 11 in., built to the order of Captain John Weatherill, of the firm of Mackenzie & Co., Dublin, for his Channel trade. This is the third vessel built by the Ailsa Shipbuilding Co. for the same owner. The engines of this, as of the two previous ships, have been supplied by Mr. Kemp, of Govan, and are 14 in., 22½ in., and 36 in. cylinders by 27 in. stroke. The vessel as she left the ways was gracefully christened *Lavinia* by Miss Lavinia Weatherill, daughter of the owner

Swanhilda.—On July 4th Messrs. A. M'Millan & Son, Limited, launched from the Dockyard, Dumbarton, a finely-modelled steel sailing ship of 2,000 tons net register, for Messrs. J. W. Carmichael & Co., Nova Scotia. Her dimensions are:—274 ft. by 42 ft. by 24 ft. She was named the *Swanhilda* by Miss Meikle, daughter of the captain of the vessel.

Coimbra.—On July 5th a steel screw steamer named the *Coimbra*, built to the order of the Oldenburg Portuguese Steamship Co., was launched from the shipbuilding yard of Messrs. Alexander Hall & Co., Aberdeen. Her dimensions are:—Length, 182 ft.; breadth, 27 ft.; depth, 14 ft.; and 700 tons register.

Kola.—On July 14th Messrs. A. & J. Inglis launched the steel screw steamer *Kola* for the British India Steam Navigation Co. The *Kola* is 250 ft. by 34 ft. by 26 ft., and will be fitted with engines of 2,000 I.H.P.

North-East and North-West.—On July 15th two trawlers were launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen, having each a gross register of 120 tons, and being of the following dimensions:—Length, over all, 105 ft.; breadth, 20[illegible]th, 10½ ft. They were built to the order of Mr. William Pyper, of Hillhead, and others, and were named the *North-East* and *North-West*.

Aranmore.—On July 15th Messrs. W. B. Thompson & Co., Dundee, launched an iron screw steamer of about 1,150 tons, named the *Aranmore*, being the latest addition to the fleet of the Clyde Shipping Co., Glasgow. This is the sixth vessel built at the Caledon yard for this company. Her principal dimensions are:—Length, 252 ft.; breadth, 34 ft. 6 in.; depth in hold, 15 ft. 8 in. She has been built to the highest class at Lloyd's, and is intended for the company's passenger trade between London and the Clyde, and also for the passage to the west coast of Ireland as occasion may require. There are five watertight bulkheads, and the three holds have two steam cranes and three steam winches conveniently placed for landing cargo. The whole of the bottom of the vessel is constructed upon the cellular system, divided into suitable compartments for water ballast. Under the after end of the poop deck handsome and roomy cabins are provided for between sixty and seventy first-class passengers. The after wheel-house, saloon, skylight, and entrance, together with the smoke-room, are all combined in one long iron deck-house on the after part of the poop deck. From stem to stern the *Aranmore* has been fitted with the electric light, carried out by Messrs. Paterson & Cooper. The engines, built at Messrs. Thompson & Co.'s Tay Foundry, are of triple-expansion type, having cylinders 23 in., 38 in., and 61 in., with a piston stroke of 48 in. Steam is supplied from two boilers at a pressure of 150 lbs. per square inch. The specifications of hull and machinery were drawn up by Mr. Hamilton, the company's engineer, and carried out under his superintendence, and that of Mr. Wylie, the company's shipwright.

Albarden.—On July 15th there was launched from the shipyard of D. M. Cumming, Blackhill Dock, an iron and steel twin screw launch, named the *Albarden*, for towing and passenger purposes at Rio de Janeiro. Dimensions:—62 ft. 6 in. by 13 ft. 6 in. by 6 ft. 3 in., moulded; her engines, which are compound surface condensing, indicating 130 H.P., being supplied by Messrs. Kincaid & Co., Limited, Greenock.

Lydia.—On July 16th Messrs. James & George Thomson, Limited, launched from their yard at Clydebank a twin-screw steamer named the *Lydia*, of 1,000 tons, to the order of the London and South Western Railway Co., for their fast mail and passenger service between Southampton and the Channel Islands. The chief requirements of the trade are a high rate of speed, with a comparatively light draught of water; and to attain this end the *Lydia* has been fitted with twin-screws. She is built of steel throughout, and has been fitted with the builders' patent rudder, with a view to giving her increased manœuvring powers in entering and leaving harbours and docks. The accommodation for first and second-class passengers will be very complete and extensive. The ship is divided into eight watertight compartments, and she will be lighted throughout by electricity. The *Lydia* is expected to be ready for her trials shortly, and will be followed by a sister ship for the same owners.

Cape York.—On July 16th Messrs. Barclay, Curle & Co., Limited, shipbuilders, Whiteinch, launched a handsome steel four-masted barque. The vessel has been built to the order of the Lyle Shipowning Co., Limited, Greenock, and is intended for the East Indian trade. Her dimensions are:—265 ft. by 41 ft. by 24 ft., and will register 2,100 tons gross. In addition to the usual outfit of Indian traders, the vessel has been fitted with halyard winches for raising and lowering the topsail yards. The vessel was named the *Cape York* by Mrs. R. P. Lyle, 107, Finnart Street, Greenock.

Phra Nang.—On July 16th the Fairfield Shipbuilding and Engineering Co., Limited, launched from their shipbuilding yard at Govan the *Phra Nang*, steel screw steamer of about 1,650 tons, built to the order of the Scottish Oriental Steamship Co., and intended for service on the China coast. Her dimensions are:—Length, 270 ft.; breadth, 36 ft. 9 in.; depth, 22 ft. 9 in. She has been built to class Veritas three-deck rate, and is similar to the *Somedetch Phra Nang*, launched from the same yard a few weeks ago.

Alexandria.—On July 17th there was launched from the shipbuilding yard of Messrs. T. B. Seath & Co. an iron screw steamer, built to the order of Empreza Esperanca Maritima de Navegacao a Vapor of Rio de Janeiro. She was built under the superintendence of Captain Manuel Francisco Logoa, and is intended for passenger and cargo service on the

Brazilian coast. Her dimensions are:—163 ft. 6 in. between perpendiculars, 28 ft. beam, 12 ft. 6 in. deep, with full poop, bridge, and topgallant forecastle. She will be fitted to accommodate 18 first-class passengers in the poop aft, and 30 second-class passengers in the main deck forward. She has been built under Lloyd's special survey, and class 100 A. Messrs. Kincaid & Co., Greenock, will supply her with triple-expansion machinery. As she left the ways she was named the *Alexandria* by Miss Cameron.

Mechelin.—On July 18th Messrs. John Fullerton & Co. launched from their yard at Paisley an iron screw steamer of 350 tons, named the *Mechelin*, built to the order of Senor E. L. Doriga, Santander, for cargo and passenger traffic on the Spanish coast. The steamer will be supplied with compound engines by Messrs. Ross & Duncan, Whitefield Works, Govan.

Prinses Sofie.—On July 19th Messrs. Caird & Co., Limited, launched from their shipbuilding yard at Greenock a magnificent steel screw steamer of 3,450 tons gross, of the following dimensions:—Length, 350 ft.; breadth, 43 ft.; depth, moulded, 29 ft. 1 in. She is built to the highest class at Lloyd's, and will be supplied by the builders with triple-expansion engines of 2,600 I.H.P., and with all the latest improvements. The cylinders will be of 29 in., 48 in., and 77 in. diameter respectively, with 4½ ft. stroke. The boilers, of which there will be two, will be double-ended, and made entirely of steel, having 12 furnaces, and will be tested by hydraulic pressure to 340 lbs. per square inch. The vessel is for the Stroomvart-Maatchappij Nederland of Amsterdam, and is intended for passenger and cargo traffic between Holland and the Colonies, &c. As she left the ways she was named the *Prinses Sofie* by Mrs. Burger, wife of the chief superintendent of the compnay.

Burmah.—On July 21st Messrs. Russell & Co. lannched at Port Glasgow a steel sailing ship named *Burmah*, of 1,600 tons net register, and of the following dimensions:—Length, 260 ft.; breadth, 38 ft.; and depth, 23 ft. 3 in. She has been built to the order of Messrs. Foley, Aikman & Co., London.

LAUNCH—Irish.

Columbian.—Messrs. Harland & Wolff have lately launched from their shipbuilding works, Queen's Island, Belfast, a large steel screw steamer named the *Columbian*. This vessel has been built to the order of F. Leylard & Co., Liverpool, and is intended to trade between that port and Boston. The dimensions are:—Length, 442 ft.; breadth, 45 ft.; depth, 34½ ft.; tonnage, 5,000. She will have triple-expansion engines, constructed by Messrs. Harland & Wolff.

LAUNCHES—German.

Göteborg.—Ou July 3rd the new steamer *Göteborg*, built for a Swedish steamship company, was launched from the Tapendrecht Shipyard, close to Rotterdam. The *Göteborg* is about 500 tons, and will have a speed of 12 knots. She is intended for the transport of herrings during the herring season from the Bohnslön coast to England and Germany.

Neptun.—The new steamer *Neptun*, built for account of the Bergen Steamship Co., Norway, has been completed at the Techlenborg Shipyard, Geestemünde. The *Neptun* is 978 tons, 212 ft. long, 30 ft. broad, and 23½ ft. deep. She has a hurricane deck, five water tight bulkheads, and is fitted out as a first-class passenger boat. Another similar steamer for a Drontheim firm is approaching its completion at the same yard.

LAUNCH—Danish.

Ella.—On June 7th the new steamer *Ella* was successfully launched from the yard of the Elsinore Iron Shipbuilding and Engineering Co., Denmark. The *Ella* is built for the "Ostersöen" Steamship Co., Copenhagen. The principal dimensions of the vessel are: Length, 148 ft.; breadth, 24 ft.; depth in hold, 11 ft. She is built entirely of steel, to highest class of Bureau Veritas, special survey. The engine is compound with surface condenser, and 250 I.H.P. The *Ella* is the fourth steamer built at Elsinore for the above company.

LAUNCH—Sweden.

Svea.—On July 2nd the new steamer *Svea*, built for account of Mr. A. Elieson, Aguhammer, and others, was launched from the yard of the Eriksberg Engineering Co., Gothenburg, Sweden. The *Svea* is built of steel, to class 85 A 3 with star in German Lloyd's; her engine will be of the Wolff type, with outside condenser, capacity, 35 N.H.P. Another steamer, the *Strömkarlen*, was launched from the same yard a few days previously. The latter boat is intended for the Gothenburg-Trollhätta traffic.

LAUNCH—Norway.

Lodsen.—On July 1st there was launched the s.s. *Lodsen*, built for the Norwegian Lighthouse Institution, from Nyland's Yard, Christiania. The *Lodsen* is built of steel, and her principal dimensions are: Length, 82 ft.; breadth, 17 ft.; depth in hold, 10½ feet.

TRIAL TRIPS.

Aros.—On June 20th the new screw steamer *Aros*, lately launched by Messrs. James Laing & Co., Deptford, Sunderland, for Messrs. Newman & Dale, had a successful trial trip from the Wear. This vessel, which is a cargo steamer, is of the following dimensions:—Length, 265 ft.; breadth, 35¼ ft.; draught, 17 ft. 3 in. The engines have been built by the North-Eastern Marine Engineering Co., Sunderland, and have oylinders 18½ in., 30 in., 49 in. in diameter, with a stroke of 33 in. During the trial the machinery worked with perfect smoothness and without a hitch of any kind.

Passenger Paddle Steamer.—On June 27th one of the two new passenger paddle steamers, built by Messrs. Richard & Henry Green, for the Bosphorus Steam Navigation Co., of Constantinople, for service on the Bosphorus, went down the Thames on her official trip, with a large party on board. The Long Reach double mile course was selected, and six runs were made, with the most satisfactory results. The mean speed realized was 13·5 knots, with an average I.H.P. of 580, and the first rnn with the tide was just under 16 knots per hour. The dimensions of the vessel are as follows:—Length, 165 ft.; beam, 21 ft.; depth, moulded, 10 ft.; draught, 4 ft. 10½ in. mean. She is built entirely of steel, and it is the intention of the Bosphorus Steam Navigation Co. to light both vessels throughout with electric light. The machinery, constructed by Messrs. John Penn & Sons, Limited, Greenwich, is of the two cylinder high-pressure oscillating type, with surface-condenser and independent circulating pump. There is also a steam reversing gear, and one steel boiler of extra size. Thronghout the trial the engines worked smoothly and gave great satisfaction. The vessel herself is fitted in the first and second saloons for about 800 passengers, and has also cabins for ladies and private cabins under the sponsons. There is a large promenade bridge deck and a large clear space aft on the main deck for the same purpose. She is steered by steam steering gear, and throughout the equipment is of the most complete character for the service for which she is required.

Kingston.—On July 1st the steam launch *Kingston*, built for Messrs. Salter Bros., of Oxford, by Messrs. Edwin Clark & Co., of Stroud, to the order of Messrs. W. Sisson & Co., Gloucester, who supplied the machinery, went on her trial trip. She is 72 ft. long, 12 ft. broad, and the engines are of the triple-expansion non-condensing type, having cylinders 5¾ in., 8¾ in., and 11¼ in. in diameter by 8 in. stroke. The working pressure is 165 lbs., and they worked without a hitch throughout.

Mayfield.—On July 2nd the s.s. *Mayfield*, built by the Bute Shipbuilding, Engineering, and Dry Dock Co., Limited, Cardiff, for Mr. Fred. Woods, London, and towed round to the Clyde to receive her machinery, which was supplied by Mr. Wm. Kemp, Govan, went on her trial trip. After adjusting compasses in Gourock bay she proceeded to the measured mile at Skelmorlie, where a speed of 10 knots was attained, which was considered satisfactory by all on board. The vessel, which was constructed under the supervision of Mr. Charles Sage, London, is of the following dimensions:—Length, 310 ft.; breadth, 38 ft.; depth, 22 ft., with a carrying capacity of 2,900 tons.

Asloun.—On July 3rd the steel steamer *Asloun*, which has been built to the order of the Adam Steamship Co., Limited, of Aberdeen, by the Sunderland Shipbuilding Co., Limited, went for her trial trip over the measured mile. The vessel had on board 4,200 tons deadweight, and averaged a mean speed of 10 knots. The engines, which are of 250 H.P. and triple-expansion, built by Messrs. Black, Hawthorn & Co., of Gateshead, gave every satisfaction.

India.—The *India*, a new steam trawler for the Hull Steam Fishing and Ice Co., has lately had her trial trip. She is the first vessel completed for this company since its reconstruction, and the contractors (Messrs. C. D. Holmes & Co.) have also two others vessels building to the same specification. The dimensions of the *India* are:—Length, 105 ft.; 21 ft. beam; 11 ft. depth of hold. She has been built by Messrs. Cochrane, Cooper, and Schofield, of Beverley. The engines have been supplied by Messrs. C. D. Holmes & Co. The trials showed an average of a good 10 knots, the boiler maintaining steam easily. The engines ran smoothly, and gave no trouble.

Queen Margaret.—On July 3rd the new steamer *Queen Margaret*, built by Messrs. Alexander Stephen & Sons, Linthouse, Govan, for Messrs. Thomas Dunlop & Sons, Glasgow, went down the Clyde on her trial trip, with a party of ladies and gentlemen on board. On the measured mile she attained a mean speed of about 11¾ knots, which gave satisfaction to the owners and their friends, being above the contract speed. The steamer's register is 2,675 tons, and she is fitted with triple-expansion engines of 300 H.P. She had on board about 2,000 tons weight, and after the trial proceeded to Liverpool to complete her loading for China and Japan.

Jessie.—On July 3rd the new steel screw steamer *Jessie*, built by the Grangemouth Dockyard Co. at their yard, went down the Firth of Forth on her official trial trip. On the measured mile the vessel attained a highly satisfactory rate of speed. The vessel has been built to the order of Mr. Wm. Twibill, of Dundalk, for the coasting trade. The engines were supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow, and are of the usual type for vessels of this class.

Knight Commander (s.s.).—On July 4th the screw steamer *Knight Commander* was taken out on her trial trip from Messrs. Palmer & Co.'s. The vessel is 400 ft. in length, 47 ft. in breadth, and 30 ft. 7½ in. deep, and is estimated to carry a cargo of nearly 7,000 tons deadweight. She is strongly built, above the requirements of 100 A1 at Lloyd's, to the order of Messrs. Greenshields, Cowie, and Co., of Liverpool, the owners of the "Knight" Line. The entire ship is illuminated by the electric light.

Dieppois.—On July 8th the s.s. *Dieppois*, of 2,680 tons deadweight, recently launched by the Campbeltown Shipbuilding Co., Campbeltown (Firth of Clyde), had a trial of speed. She steamed at the average rate of 11$\frac{4}{10}$ knots per hour, fully attaining the guaranteed speed. A number of guests, invited to enjoy a day's sailing, afterwards sat down to dinner. These included Monsieur Delarue, of Dieppe, the owner; Monsieur Vosien; Mr. Lucas, representative of the Bureau Veritas; Mr. Robertson, of Lloyd's; Mr. Dewar, of Messrs. Jas. Rankine & Son, Glasgow, &c., &c. Mr. Delarue, in wishing prosperity to the Campbeltown Shipbuilding Co., and to Messrs. Muir & Houston, the engineers, expressed the great pleasure the day's proceedings had given him, and especially at the entirely satisfactory results of the speed trials. The dimensions and particulars of the steamer are as follows:—260 ft. between perpendiculars, by 36 ft. 9 in. by 19 ft. 6 in., moulded, raised quarter-deck, bridge to foremast, topgallant forecastle, double bottom throughout, web-frames, steam steering gear worked from both bridges, Harfield's patent windlass. Engines, triple-expansion, having cylinders 19 in., 31 in., 51 in. by 39 in. stroke supplied with steam at 160 lbs. working pressure from two large single-ended boilers having three furnaces in each. Ship and engines are fitted with all the latest improvements for speedy loading and discharging of cargo and for sea work, including Weir's patent evaporator and boiler circulator. The whole has been built under the superintendence of Lloyd's and the Bureau Veritas to obtain their respective highest class. The *Dieppois* will sail for Havre shortly, thence to Saignon. The Campbeltown Shipbuilding Co. have still a steamer of 1,850 tons dead-weight building on their own account about ready to launch.

Tafna.—On July 9th the new steamer *Tafna*, which has been built and engined by Messrs. Wigham Richardson & Co. at their Neptune Works for La Compagnie Anonyme de Navigation Mixte of Marseilles, went to sea for her trial trip. The weather was very fine, and during a series of runs over the measured mile she attained a speed of 13½ knots per hour. This vessel is the sixth constructed for the same owners by Messrs. Wigham Richardson & Co., and is intended for the passenger service between Marseilles and Algiers, being very completely fitted up for first, second, and third class passengers.

The Duke.—On July 10th the new s.s. *The Duke*, recently launched by Messrs. John Fullerton & Co., Paisley, and built to the order of Messrs. J. & J. Hay, Renfield Street, Glasgow, for their coasting trade, went down the river on her official trial trip. After adjusting compasses, the owner and a numerous company of gentlemen went on board at Greenock, and at once proceeded to run the measured mile at Skelmorlie. The steamer was fully laden, and the speed obtained was 9¾ knots. The engines, which are triple-expansion, were supplied by Messrs. Muir & Houston, Glasgow, and worked admirably during the entire day.

Salado.—On July 10th the s.s. *Salado*, a steel screw steamer built by Sir Raylton Dixon & Co., Middlesbro', for Messrs. Arthur Holland & Co., London, proceeded from the Tees on her trial trip. She is built with poop, raised quarter-deck, long bridge and topgallant forecastle, and is of the following dimensions:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 8 in., with a deadweight capacity of about 3,300 tons. Her engines, which have been fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland, are of 180 I.H.P., having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. Sir Raylton Dixon & Co. have launched during the first half of this year ten steamers of 23,000 tons gross register.

Wodonga.—On July 11th the *Wodonga*, built by Messrs. A. & J. Inglis, Pointhouse, for the Australian United Steam Navigation Co., London and Brisbane, was officially tried at Skelmorlie, the speed attained being 15·52 knots. The trial was much impeded by the yachts engaged in the sailing matches which were started from Wemyss Bay, and the running on the measured mile had to be abandoned before quite the maximum speed had been ascertained. However, as the conditions of the contract had been amply fulfilled, it was deemed advisable to cut the trials short.

Glen Caladh Tower.—On July 12th the *Glen Caladh Tower*, a large spar-decked screw steamer, which has been built and engined by Messrs. Robert Stephenson & Co., Limited, of Newcastle and Hebburn, for Messrs. F. Stumore & Co., of London, was taken out to sea for a trial trip. She is of the following dimensions:—Length, 361 ft.; breadth, 41½ ft.; depth, 29 ft. She has a deadweight capacity of about 4,500 tons. Her propelling machinery consists of a set of triple-expansion engines, having cylinders 25½ in., 41 in. and 67 in. diameter, and 42 in. stroke; there are two double-ended boilers, with a working pressure of 160 lbs. The vessel attained a mean speed of 11¼ knots on a series of runs over the measured mile. This is the fourth vessel built and engined by Messrs. Stephenson for the same owners. There was a large party representing the builders and owners on board, and complete satisfaction was expressed with the result of the trial.

Kingsland.—On Saturday morning, July 12th, the trial trip of the s.s. *Kingsland* took place in Hartlepool Bay. We gave particulars of this steamer in the account of the launch in the July No. She is the thirteenth steamer built for Messrs. Watts, Ward & Co., of London, by Messrs. Wm. Gray & Co., Limited, of West Hartlepool. She carries 3,000 tons deadweight, and is fitted with triple-expansion engines of 800 H.P. by the Central Marine Engine Works. After taking in bunker coal a trial was made in Hartlepool Bay of the machinery, when everything worked to the full satisfaction of the owners and builders. Mr. Thomas Mudd was present on behalf of the latter. Capt. Hodgson and Mr. A. H. Alchin on behalf of the former. After the trial the vessel proceeded to Antwerp to load for the River Plate.

Fleur-de-Lys.—On July 14th the steam yacht *Fleur-de-Lys*, built to the order of Colonel Pope, by Messrs. T. G. Tagg & Son, of East Molesey, and engined by Messrs. W. Sisson & Co., Gloucester, went on her trial trip at Long Reach. The engines are on the triple-expansion principle, with cylinders 6 in., 9 in., and 15 in. in diameter by 10 in. stroke. The working pressure is 150 lbs.

Trevaylor.—On July 15th the steel screw steamer *Trevaylor* was taken to sea on her trial trip. She has been built by Messrs. John Readhead & Sons, of West Docks, South Shields, and is the twenty-first steamer built by that firm to the order of Messrs. Edward Hain & Sons, St. Ives, Cornwall. Her principal dimensions are as follow, viz.:—200 ft. by 40 ft. by 21 ft., and she is of the improved well-deck type, having poop, raised quarter deck, long bridge, and top-gallant-forecastle. She is classed 100 A1 at Lloyd's, and was built under special survey. She has steam steering gear, direct-acting steam windlass, and every appliance for securing efficient and economical working, and is fitted with shifting boards and bulkheads, according to the Grain Cargoes Act. The ship is also fitted with triple-expansion engines, having cylinders 23 in., 37½ in., and 61½ in., by 39 in. stroke, supplied with steam from two large steel boilers, having a working pressure of 160 lbs. The engines and boilers have also been made by Messrs. John Readhead & Sons. On the trial everything worked with the greatest smoothness, the results being completely satisfactory to the builders and owners. The mean speed attained on the measured mile was 11½ knots. The *Trevaylor* will shortly proceed on a voyage with coals to Genoa, and thence to the Black Sea, under the command of Captain Quiller.

Julia.—On July 15th the s.s. *Julia*, built to the order of Theodor Rodenacker, Esq., Dantzig, in conjunction with Messrs. Bremer, Bennett & Bremer, London, by Messrs. C. S. Swan & Hunter, Wallsend, and the seventh steamer constructed by the same builders for them, went for her trial trip, on a run from Tynemouth to Coquet Island and back, on which a mean speed of 10·4 knots was obtained. The vessel is 228 ft. long, 34 ft. 6 in. broad, and 21 ft. 6 in. deep, moulded to spar deck, and built on the spar deck grade to Lloyd's highest class with bridge-house amidships, under which is the saloon and captain and officers' accommodation. Water ballast is in a cellular-double bottom and both peaks. The engines are by Messrs. Black, Hawthorn & Co., Gateshead, cylinders, 18 in., 30 in., and 48 in. by 36 in. stroke.

Mana.—On July 15th the paddle steamtug *Mana*, recently built by Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, went down the river on her trial, and on the measured mile attained a mean speed of 10½ knots per hour. This steamer is fitted with two sets of disconnecting compound surface condensing engines, working at a pressure of 100 lbs., and indicating 650 H.P. She has been built under the superintendence of Mr. John Darling, Union Steamship Co., New Zealand, who on behalf of the Timaree Harbour Board expressed himself as highly pleased with everything on board.

Perth.—On July 16th the s.s. *Perth* went from Dundee to the Forth Bridge on a trial trip. The *Perth* has been built for the Dundee, Perth, and London Shipping Co. by Messrs. W. & B. Thompson. The distance from Dundee to Forth Bridge is sixty-five miles, which was accomplished in three and a-half hours, or eighteen and a-half miles per hour. The *Perth* is 290 ft. 6 in. in length, 36 ft. 6 in. breadth, and 18 ft. 2½ in. depth. The breadth is 2½ ft. more than in the sister ship *Dundee*, giving a very great addition to the room in the ship. The engines gave 2,950 indicated H.P.

Nordvest.—On July 18th the new steamer *Nordvest*, built at the Elsinore Iron Shipbuilding and Engineering Co., Denmark, for the Norden Steamship Co., Copenhagen, had its official trial trip in the Sound. The steamer has the following principal dimensions:—Length in main deck, 260 ft.; breadth, 36 ft.; depth in hold, 18 ft.; and will carry 2,300 tons. The engines are on the triple-expansion system, and indicated on the trial trip 730 H.P. at a speed of about 11½ knots.

Strathallan.—On July 18th the s.s. *Strathallan*, lately launched from Messrs. Russell & Co's Greenock Yard for Messrs. Burrell & Son, after being engined by Messrs. James Howden & Co., and loaded with the greater part of her cargo, left Glasgow Harbour, and after adjusting compasses had a trial of her engines in the Channel. The steamer is 298 ft. by 40 ft. by 19 ft 6 in., is built with full lines and carries 3,550 tons dead weight on a light draft. The engines have cylinders 22½ in., 35½ in., and 58½ in. diameter by 39 in. stroke, and are supplied with steam of 160 lbs. pressure from two boilers fitted with Howden's patent forced draught. The engines worked most satisfactorily and the mean speed on the measured mile at Skelmorlie was 10·5 knots with easy steaming. The party representing owners, builders, and engineers landed at Greenock, and the vessel proceeded on her voyage. The *Strathallan* is the fifth steamer completed for Messrs. Burrell & Son by the same builders and engineers within the last two years.

Review.

The Naval Annual. By Lord Brassey. (Griffin & Co., Portsmouth, 1890.)

This unique publication has now reached its fourth yearly issue, and has therefore presumably proved its *raison d'être.* It is obvious that with the interest there always is in this country upon naval questions and the vast sums of money spent in this department, that any work bearing upon the above subject, even if only tolerably complete, is always sure to meet with a fair reception. When, however, not only the English Navy is unmasked, but a good attempt is made to show what leading nations are doing, the number of readers is likely to be very much more extended. We have, in fact, an *exposé* of how the world wags in naval matters. On the other hand, with such a wide field upon which to draw, the compilers render themselves open to very many more possible flaws than if they merely endeavoured to represent how England alone stood in this particular. The object, though large, is, however, a laudable one, and will no doubt, even with any errors of omission or commission, be more acceptable to the class which it is intended to cater for.

With these prefatory remarks, we may state that the work is divided into four great divisions, the first, for which Lord Brassey is himself responsible, being concerned with everything that appertains to our own Navy and its relation to that of other Powers, and which, being the main body of the work, embraces nearly half its pages. The second part, by Mr. F. K. Barnes, is taken up with tables of British and Foreign armoured and unarmoured ships. The third, by Captain Orde-Browne, is devoted to armour and ordnance, while the fourth comprises official statements and statistics bearing upon the whole subject. In the introduction we find general reasons given for England's large contribution to this arm of the service. Many of the debatable questions of naval warfare are mentioned, such as that of the safety of large seaport towns, which, without much defence, are liable to attack from the enemy. Then again, the destruction of richly freighted merchantmen, under cover of the night, by a hostile torpedo boat, and the duties of commanders in these and like circumstances, are some points which claim attention. The Eastern problem is, so far as it is mixed up with naval supremacy and the present aspect of political affairs, generally make, in conjunction with some remarks on the recommendations of the recent Commission upon naval and military affairs, a fitting prelude to the volume proper. To keep up to date, the manœuvres of last year are first described. The different fleets are tabulated, with the names of the commanding officers, and a complete history of events follows. The lessons drawn appear generally to be in favour of these mimic actions, excellent experience being said to be afforded to the higher ranks of officers as well as to those charged with the types of vessels of which the Navy is composed. Here we are said to be short of scouts, that is, very fast ships capable of making reports to the Admiral commanding, where everything is sacrificed to engine power and fine lines. Speed is, however, deemed efficient in all English men-of-war. The machinery is described as too light to stand the strains of continuous running, while a prominent defect of the gunnery department put forward is a multiplicity of sizes in the ordnance, necessitating a corresponding variety in the ammunition with the consequent possible mistakes at a critical moment. Under the heading, training, the importance of squadrons of master ships for initiating officers and men into the mysteries of sailing is insisted upon in these days of steam power. Another recommendation is that engineers and stokers of the Navy should make a few voyages in some of our leading lines of mail steamers to see into the routine of the mercantile service. Much good would certainly be obtained thereby. In connection with naval reserves it is stated that lieutenants and sub-lieutenants receive after twelve months' service £25 and £20 a-year respectively, but that nothing has been yet offered to engineers so qualifying. The naval volunteer movement is put forward as not altogether a complete success. Various reasons are adduced for this condition of things, and the compiler ventures to state remedies of which an interested reader will be the best judge. The system of the distribution of our men-of-war on foreign stations is criticised, and the composition of the several fleets. On this branch of the subject the compiler is very much to the point. Even with the improvements in recent years we are still apparently adhering too pertinaciously to tradition. That, however, the Cape and south-east coast of America squadrons should be amalgamated seems a very drastic reform. Whether the powers that be would consent to do away with one command is little likely, though from the fairness of the vessels concerned there is certainly a good deal in the suggestion. The full knowledge Lord Brassey has upon what he writes is shown by the far-reaching character of such proposals. The naval and military views concerning the value of fortresses are tersely put, and the question of the navy assuming control of our coast defence is well debated. Due importance is given to the protection found in Australia and our coaling stations. No one is better able than the compiler to apportion a proper value to these positions. The places have been visited by him in his voyages, and it is satisfactory to find we are not so badly off in distant parts of the world for the maintenance of our trade communications in times of war. Still there yet remains something to be done. These pages show what that something is. With 21 millions voted for the Navy under a special Act of Parliament last year no annual would be complete without particulars of the programme now being carried out. We find what is allotted to the dockyards and what to contract and the several alterations that have occurred in the policy ruling at headquarters. In a brief manner the programmes for the year of other Powers are also discussed. It is comparatively easy, therefore, to compare the net gains made by each. In the category Chili, Japan, Greece and Turkey are included. Descriptions of our own fleet are especially minute, and the same may be said of ships in the French Navy. Recommendations are made as to the re-engining of some, if not all our older ironclads, the hulls being in such good condition. This is being carried out with the *Hercules* and other ships at the present time. The necessity of applying the same modern character to the armament as well as the engines is brought out. The tendency in this direction is towards lighter ordnance and more of it. As regards the general style of vessel in the future, the consensus of opinion seems to be in favour of more ships with little or no armour and a very high speed. We are now said to want vessels of reduced dimensions and armed with a single turret fore end on firing instead of the monsters that have been turned out of hand in recent years. Outsiders were of the same opinion long ago. Smaller Powers with less means at their disposal have adopted these dispositions and possess some very first class ships at a reasonable cost. The French ironclads are said, on p. 208, to be better adapted for manœuvring in a seaway with their high bows, than we are with our own low freeboards. The limit of size fixed upon for a ship for fighting purposes is put down as 10,000 tons. Beyond this it is supposed too many eggs are going into the one basket. The arrangements for coaling a man-of-war rapidly are not what could be wished for, if we may judge by the figures given—40 tons per hour seems the rate in some of the smartest ships. When we turn to the second part, Mr. Barnes' name is a sufficient guarantee that the labours allotted to him are done well. The speed and coal endurance columns are obtained from actual trials as far as possible. The mail steamers subsidised by the Government are included in the list. Countries are afterwards treated in alphabetical order, irrespective of the tonnage each can muster. The principal point of interest in this division is, perhaps, the plates of most of the ships of the world that fly a pennant, and drawn generally to the same scale. The position of the armour is coloured, so that a very ready comparison can be made. Every effort seems to have been made to render these plates of service by means of sections and plans where elevations are not sufficient for the purpose. There are necessarily, we suppose, some omissions. The authorities are not in every case as ready to expose their hand with their weaknesses as well as their trump cards. This remark does not apply, however, where money has been unstinted, and there has been an adequate return for it. We thus find Russia, Germany, France, Italy, and the United States in this collection.

Captain-Orde Browne plunges into the part he takes with pictures of the effects on prepared armour of different varieties of projectiles. The victory seems to rest for the moment with armour, Brown's steel faced pattern being said to have resisted the impact of anything that can be brought against it better than [illegible] other. Ready rules are found to guide anyone as to th[illegible] capabilities of a gun on armour. As, however, the [illegible] manufactured to withstand severe blows, it is [illegible] have any effect on hard plates continuous fire [illegible] The chapter on ordnance is especially interesting. We regret to find it stated that English results are below our neighbours the French, the actual figures being furnished. The French are said also to excel the Germans. We, however, are behind both. Whether, however, the specimens mentioned are on board our adversaries' ships is not clear. The outlook is, however, sufficiently disquieting. The tendency in big gunnery is towards longer barrels and slower burning powder. Some space is next devoted to quick-firing guns, magazine rifles, and smokeless powder, the latest developments in this branch. Short tables follow after of British and foreign ordnance, with the projectiles used, and the effects when fired.

The last division may pass without notice, though it covers considerable ground and takes up over 100 pages. From the fact that the matter in the annual is not original, it is difficult to obtain that smoothness that is usual with an ordinary volume. Something must be sacrificed to utility and correctness. Without these features success would be wholly wanting. Viewed in this light, however, why do we find no notice of that important branch, engineering. What we have hitherto perused on the subject by other authors has always been full of details relating to the main and auxiliary machinery. It would have been thought there were many capable of assisting to publish what was known in this department and thus have added another division to the work. Space might readily be found for this by expunging a good deal of the first and fourth parts, or what amounts to the same thing, editing instead of compiling newspaper cuttings, speeches, &c. If this could be done well, and there would seem no reason to the contrary, the results would we think be more satisfactory. As it is at present, the volume is too unhandy altogether. In some respects it gives the impression of amateurish, whereas if the plan we advocate were followed there could be no chance of that repetition which we fear is a somewhat prominent feature in the present form. Be that as it may, all who want to know the latest in naval circles will be most likely to find it in this annual.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

SUPPLYING MARINE BOILERS WITH FRESH WATER.

To the Editor of The Marine Engineer.

Sir,—In The Marine Engineer of June last there is an editorial note pointing out the necessity of supplying high-pressure boilers with fresh water to make up the loss that takes place at sea, advocating the use of evaporators, and giving the necessary requirements and precautions for their safe working. As we are the original patentees and introducers of the evaporator, you will no doubt grant we ought to know something about the matter.

With regard to the means for admitting the sea water which is evaporated, you say, "These ought to be automatic, and should be so arranged that if the feed valve leaks or gets set fast, the fact will be evident, and the valve easily liberated." To a practical engineer this statement needs no comment; and you seem to take such an apparatus at its proper worth, for you further suggest that "there should not only be an automatic admission but an equally automatic emission."

In another portion we are told, "It is of the greatest importance in arranging make-up feed evaporators that the passage of water from the evaporating vessel into steam pipes, under any circumstances, may be impossible, or damage more or less serious will result." This is perfectly correct, but the amount of feed-water put in by a pump properly proportioned and constructed for the purpose is very small indeed, and there is no fear of this quantity doing any damage. In fact, it is only when using automatic feed of the kind described that the danger of water being carried over is really introduced, for with such a pump as we mention there is no chance of it getting over whatever. The real danger, however, lies in getting water over by the apparatus priming—a very serious matter. To overcome this we have conducted a series of experiments at a considerable outlay, and extending over some years; and it was not till we were thoroughly satisfied with the efficiency of our evaporator in this respect that we placed it in the market. Until we had found out the cause of the seemingly unaccountable priming and its remedy, which is our patent, no trustworthy data existed of the efficiency of copper surfaces to transmit heat when evaporating water; and for such information on the subject of practical evaporation, we beg to call your attention to the Board of Trade report on the experimental tests of our evaporators, in which Mr. F. W. Traill says:—"The few data which hitherto existed on the subject of evaporating by means of steam within tubes vary so much that they cannot be applied with any sense of security, and the results of these carefully-made experiments are of considerable value and importance for purposes beyond that for which they were specially made, and will be of great value to the staff and others." We would also direct your notice to the paper "On Evaporation," by Mr. Charles Lang, contained in last year's volume of the "Transactions" of the Institute of Engineers and Shipbuilders in Scotland.

In concluding, you say, "The experiment has been tried of taking the vapour into the low-pressure cylinder jacket in order to get a certain amount of work back for the heat expended. We have no definite information as to the result of this, but as a practice it would appear to be open to objection that if the sea-feed connections are not thoroughly trustworthy, accidents may arise from overflow of water where steam or vapour alone should pass." The term "jacket" is here used in an ambiguous sense, but from the context it appears that it is not the jacket that is meant but the receiver. We infer, therefore, that the low-pressure receiver is meant, and on the result of taking the vapour there, we can supply you with definite information, as this is the system patented and practised by us.

The effect of taking steam from the intermediate receiver to evaporate water and putting the evaporated steam into the low-pressure receiver, compared with taking the steam direct and putting it into the condenser, is, that three times the amount of fresh water is supplied for the expenditure of a given amount of fuel; or, stated differently, three times more fresh water is produced for an equal expenditure of steam by our system than by that of taking boiler steam and evaporating to condenser direct. The large number already supplied, and the growing demand for our evaporators on this system, are such that it cannot now, in truth, be termed an experiment, and the opinions of the leading shipowners and engineers amply testify to the success of our method.

Holm Foundry, Cathcart, Glasgow, G. and J. Weir.
June 20th.

REMOVING THE LIVERPOOL BAR.

To the Editor of The Marine Engineer.

Sir,—I find from a map of the Mersey Docks and Harbour Board of last year's soundings of the part known as the Liverpool Bar, that the water at low spring tide is only 10 ft., and at a point and on a line 300 yards north of and parallel with the line between the Bar Lightship and the Formby Lightship that the distance across the bar, from 18 ft. depth inside to 27 ft. depth outside, is 1,800 ft., outside of which there is ample depth of water and plenty of space to deposit sand from off the bar. My plan to deepen this part is by assisting the current to scour out a channel through the 1,800 ft., bringing it down at least to the 18 ft. inside. The reason why I take the depth from 18 ft. to 27 ft. is in order to have grade to assist the current to carry out the sand. My plan would be to get a set of gang ploughs attached to a V-shaped frame, drawn by a tow-boat, turning over and entirely loosening the sand, which the last of the ebb tides would carry out, and which could be assisted by the use of force-pumps stirring and driving the sand. Also the slickings from the docks could be let down on it from the hoppers in quantities, which would materially assist in moving the sand along with it; also by temporary guides, forming lines on which the current would act. On making a plan of the bar I find from the different depths, and to do the work by sections in order to get as much grade as possible to work on, that from the point section 1, at which the water is 10 ft., to the 27 ft., a distance of 900 ft., there is a grade of 17 ft., or 1 ft to 53$\frac{1}{17}$; that section 2, from 12 ft. to 27 ft., distance 1,200 ft., grade of 15, equalling 1 ft. to 80 ft.; section 3, from 14 ft. to 27 ft., distance 1,500 ft., grade of 15 ft., fall, equalling 1 to 115⅜; No. 4, 18 ft. to 27 ft., distance 1,800 ft., 9 ft. grade, equalling 1 to 200. The best result would be got on the last runs of the spring ebbs, as with the least depth of water the greater would be the scour, and the action of the tide outside the bar from the 27 ft., with the great area, would scatter the sand out of the way. My knowledge of the action of water on material in sluices as well as in rivers has been derived from a varied experience in the gravel mines of California, and I fully believe that by following the substance of the above principles, with probable additions which might suggest themselves as the work went on, and with the large quantity of water which comes in and out of this large basin, that by assisting nature the bar can not only be materially lowered, but can with little help be kept deep enough to enable the largest ships to enter at all times, except perhaps at extreme low tides, keeping Liverpool as it is—the first port of the world. In conclusion I may just add that the plant for carrying out the scheme above suggested would cost but little—the services of a towboat being the principal.

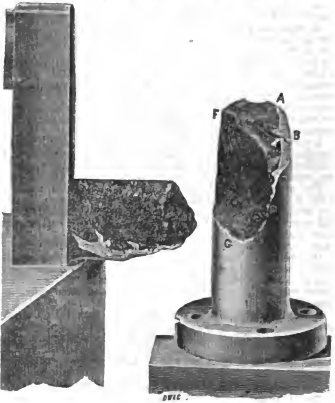
Yours respectfully,
Joseph McGillivray.

4, Redcross Street, Liverpool.

FRACTURED CRANKSHAFT.

To the Editor of The Marine Engineer.

Sir,—I enclose a photo. of fractured crankshaft of one of our steamers, if you can find space to illustrate it in your paper, I daresay it would be of some interest to a lot of your readers. The fracture from F to G in after bearing was first noticed out abroad when examining bearing, this the chief engineer reported home, and the ship proceeded on her homeward passage of nearly 2,000 miles. Neither the bearing nor shaft gave the slightest trouble on passage home, although driving at usual speed. Upon arrival here the fractured shaft was replaced by a new one, and to ascertain the extent of the fracture, the old shaft was broken, of which this photo. is a correct likeness, showing the extent of the flaw, particulars of which are as follows:—Section of solid metal at A, = ½ in.; B, 1$\frac{1}{16}$; D, ⅝ in.; F, ½ in.: mean, ⅝ in. bare; length from A to E, 12 in.; shaft made of iron, 6¾ in. diameter, fracture in after bearing; the small remaining portion of solid metal was the driving side.



Yours, &c.,
R Y.

Leith, 21st June, 1890.

TRIPLING OR QUADRUPLING.

To the Editor of THE MARINE ENGINEER.

SIR,—The approach of low freights, and the fact of high working expenses, which have already combined to induce many shipowners to lay up some of their old compound boats, must shortly bring before their notice the necessity of altering the older type of vessel so as to place them on a line with the modern triple-expansion boats. Many firms have already put triple-expansion engines into old compound boats, and with good results. But this process is more costly, and considered less effective than the system of quadruple-expansion. Quadruple-expansion engines have been built for a considerable number of vessels, and have given somewhat better results than triple-expansion. The chief difficulty lies, as a rule, in the increased pressure of the boiler, *i.e.*, the factor, which causes the great saving in fuel, is the one which gives the most bother. It would be useless to again unearth the theory of the Perkins or Hereschoff tube boilers, for our most eminent engineers have now practically come to the conclusion that for a seagoing vessel making long voyages, the circular boiler is the only one which can with safety be relied on. Pressures of 200 lbs. per square inch in circular boilers have now been introduced, and we may safely say that the circular boiler for a quadruple-expansion engine has passed through its infancy.

My idea in quadrupling the present compound engines would be—

1st.—To save space, *i.e.*, to put the two new cylinders over the two present old ones, and to run the engine on two cranks only.

2ndly.—To leave the present shafting, engine seating, boiler spaces, &c., unaltered.

3rdly.—To take advantage of the saving in fuel resulting from the use of steam at 200 to 225 lbs. working pressure.

In replacing compound engines by the triple-expansion engine we should either have to place the new H.P. cylinder on the old H.P. cylinder, and put up with the unequal power exerted on the two cranks, or we should have to spend an additional £1,000 or more for an engine of say 1,000 H.P. effective to increase the length of the engine seating, shift bulkhead, thus reducing cargo space, fit additional crank shaft, and, in fact, reconstruct the engine-room entirely. All this would be avoided by quadrupling, and an increased economy in coal over triple-expansion engines would result.

A careful adjustment of the sizes of the cylinders, and the length of stroke to which the steam would have to be carried, so as not to exact more power than the old working parts are suited for, would offer little difficulty.

The cost of quadrupling an engine of say 200 H.P. nominal, 1,000 H.P. effective, inclusive of new boilers, would not exceed say £3,000, and if a shipowner is reminded that he can make an old steamer of 3,000 tons more than equal to a new triple-expansion boat at this small expense, plus a few months' delay, he must undoubtedly heave a sigh of relief and satisfaction.

Our engine builders will soon begin to look for fresh work, and in view of the reduction in orders for new engines, they will no doubt be prepared to offer low prices for this alteration, which will keep their works busy till the present depression has passed.

The laying up of many old boats for this purpose will in the meantime relieve the freight market. My advice to shipowners therefore is: Don't build new boats, and thereby further depreciate the old property, you had better quadruple your present compound boats, instead of selling them to foreigners for an old song. GEORGE JAQUES.

THE "NOMOS" COMPOSITION FOR COATING SHIPS' BOTTOMS.—We have been looking through the new list of vessels coated with the "Nomos" composition, and find that this particular paint is making good headway. This is shown by the large number of vessels on which it has been used, and by the fact that the most of those firms who were amongst the first to try are still using it upon their vessels and are increasing their orders. The list of the manufacturers, Messrs. R. T. Bruce & Co., Hull, show that during April and May over 120 vessels were coated, and we learn from the same source that the Royal Mail, the Wilson Line, the Hamburg-Pacific, Messrs. Bailey & Latham, &c., &c., are now using this composition. There seems to be good grounds for believing that the success which this composition has already attained will be further increased as its merits become better known.

Miscellaneous.

FRENCH SHIPBUILDING.—French shipbuilders are rejoicing much over the success of the trial trip of a vessel called the *Caen*, which has been built in Havre for the fruit and vegetable traffic beween Dieppe and Newhaven. This trade has grown very rapidly of late years, and the *Compagnie de l'Ouest*, which works this route in conjunction with the London, Brighton & South Coast Railway, ordered two steamers specially adapted for this kind of business. The *Caen* is the first of these boats. According to the specifications, the craft were to be capable of transporting 150 tons of fruit and similar commodities from Dieppe to Newhaven in 5 hours, but on its first trip the *Caen* accomplished the passage in an hour less than the prescribed limit, the exact time occupied being 3 hours 48 minutes. Hence the maritime congratulations. Whether the new vessels will lessen the price of fruit to the metropolitan consumer is a problem that only time will solve.

IMPROVED STEAM SERVICE TO CANADA.—The principal conditions in connexion with the tenders for the proposed improved steamship service between Canada and the United Kingdom and France are as follows:—It is stipulated that the service shall be a weekly one each way, and the first and last port of call in England, Plymouth or Southampton, and in France, Cherbourg or such other port as may be agreed upon. The ports in Canada to be Quebec in summer, and Halifax, or Halifax and St. John in winter, the steamers calling to land and embark mails at Rimouski during the season of summer navigation. The contractor to have the right, after landing the mails, to send the steamers on from the terminal ports to any other ports in England, France, or Canada, but the steamers are in no case to call at any foreign port other than as above provided for. In consideration of the subsidy that may be asked for, the steamers will be required to carry the mails from Canada to the United Kingdom and the continent of Europe, and *vice versâ*; and proper accommodation and space are to be provided for them in each steamer. The days and hours of departure of the steamers to be appointed by the Postmaster-General, who is also to have the right, in case of need, to delay the sailing of any steamer for a time not exceeding 24 hours. It is desired that the new service shall commence on the 12th of April, 1891, or as soon thereafter as possible, the contract to be for 10 years as a fixed term, and to continue thereafter until determined by either party on 12 months' notice. The vessels employed are not to be of less tonnage than 6,500 gross register, and to be of adequate strength and power to make an average speed of not less than 18 or 19 knots from port to port. Alternative tenders may be made for 18 and 19 knots, and the steamers are to be in all respects first-class mail steamers and equal in equipment to any that are crossing the Atlantic. The contractor to receive and deliver the mails at the post-offices at the ports, and to bear the expenses of conveying the same between the steamships and such post-offices. There are several minor provisions, and it is also required that parties tendering shall send with their tenders the names of two persons as security, to the sum of £20,000 sterling, for the due performance of the contract.

POLLOCK'S "DICTIONARY OF THE CLYDE."—This handy and most complete guide to Glasgow and the Clyde has again this year been issued to the public—in even a more attractive form than either of the two previous annual issues. Than this unique guide—a combination of the holiday handbook and the library gazetteer—we know of no other work so well-fitted to supply, in a convenient form, all the information regarding the Clyde and West of Scotland that can possibly be required by either tourist, resident, yachtsman, angler, or by the specialist interested in the industries, shipping, geology, botany, poetry, and scenic beauties of the Clyde, from source to sea. It is a marvellous shilling's-worth, extending to close on 300 pages, and is fully provided with maps by Bartholomew, of Edinburgh. Menzies & Co., of Edinburgh and Glasgow, and Simpkin, Marshall; Hamilton, Kent & Co., London, are the publishers.

"PETROLEA NO. 1."—This vessel, of novel construction, has lately commenced her first passage upon the Rhine. She is intended for the transport of petroleum from the depôt at the mouth of the river where the oil is received from ocean-going tank steamers. She was built from the specifications under the superintendence of Messrs. Hannery & Blackiston, of London and Liverpool, for the economical distribution, in the upper reaches of the Rhine, of imported oil. The vessel is 226 ft. 4 in. long, 31 ft. 2 in. broad, 7 ft. 16 in. deep, and has a draught of water of less than 7 ft. when fully loaded with nearly 1,000 tons of oil. She has masts and sails and apparatus for towing, and is of very light scantlings, suited specially for river traffic. She is fitted with complete set of pipes and pumping arrangements, and water ballast to enable her to be readily trimmed on even keel to secure the minimum of draught. The vessel was built by Messrs. Ewald, Berinngham, & Co., and has externally most of the appearance of the ordinary Rhine barge for general cargo.

A NEW RUSSIAN CRUISER.—The torpedo-Aviso boat *Adler*, constructed in Germany for the Russian Black Sea fleet, is described by the Russian papers as the fastest war-vessel afloat, having attained during its trial trip a speed of 26·55 knots. The boat is 150 ft. long and 17 ft. broad, with a displacement of 150 tons. Its two sister vessels—the *Anacrea* and *Kozarsky*—have only a speed of 21 knots; but three gunboats, one of which—the *Narghen*—is finished, are being constructed in German shipyards for the Baltic fleet, and these will be almost as fast steamers as the *Adler*.

THE PROPELLER AMIDSHIPS.—A trial trip of the *Dhui Heartach*, which has been altered and adapted to test the advantages to be gained by having the propeller amidships, instead of as by the recognised method—viz., at the stern—was made in the above vessel from Hartlepool to the Newcastle Quay. Although the vessel was quite light, not even ballasted, she behaved admirably. It was manifest that perfect contact with the water, under the ship, was at all times certain for the propellers, so that there was no racing or unequal strain upon the engines. In fact, whether rolling or pitching, the propellers were never visible, nor was the surface of the water directly over the propellers ever broken, and the manifest disturbance to those who were on board was only that of a mere bubbling round to the stern of the vessel. Therefore there was no turbulence in the neighbourhood of the rudder, and steering was a mere pastime, the ship answering easily and quickly to her helm. The vessel is now in the Tyne being further tried and examined.

ELECTRIC LIGHT IN THE SUEZ CANAL.—The number of vessels passing through the Suez Canal at night by means of electric light is increasing with extraordinary rapidity. The regulations for the use of the electric light came into operation in March, 1887, and during the remainder of that year (according to statistics given in the recent British Consular report from Port Said) the number using it was 394. In 1888 the number rose to 1,611, and last year reached 2,445. Prior to March, 1887, the privilege of travelling by night with electric light had been restricted to vessels carrying the mails; since then all ships which conform to the regulations are allowed to proceed by night. The average time of transit has also been considerably shortened. In 1886 it was 36 hours; in 1887, 33 hours and 58 minutes; in 1888, 31 hours and 15 minutes; and in 1889 it had been reduced to 25 hours 50 minutes. The average time for vessels using the electric light in 1889 was 22¼ hours. The shortest time taken by a steamer in the transit of the Canal in 1889 was 14½ hours, which is ten minutes less than the fastest passage on record previously.

"ANDREA DOREA."—The new Italian battleship *Andrea Dorea* underwent her full power steam trials on July 10th off Spezia. This vessel, the *Ruggiero di Lauria*, and the *Francesco Morosini* form a group very similar in design to the *Admiral* class of our own Navy. They are of 11,000 tons displacement, 328 ft. long, and 65 ft. 4 in. beam. Their engines, 10,000 H.P., were intended to give them a maximum speed of 16 knots. The armament exceeds anything we have hitherto attempted, or are likely to attempt, consisting as it does of four 110-ton Elswick guns, mounted in two barbettes, two 6-inch quick-firing guns, and twelve machine guns. The machinery of the *Andrea Dorea* and the *Ruggiero di Lauria* is by Messrs. Maudslay, Sons & Field, Lambeth, and is of the three-cylinder inverted with triple-expansion type, working twin screws, and fitted with Joy's patent valve gear. Steam is supplied by eight large double-ended boilers, arranged in close stokeholds. The *Andrea Dorea* left the Gulf of Spezia at 10 a.m. Everything worked well, and an air-pressure in the stokeholds of only ¾-inch was found quite sufficient to maintain the power required. The result of the day's run was a mean H.P. of 10,500, and an average speed of 16·1 knots. The coal was unpicked, and the stokers were Italian.

AN INDIAN STEAMSHIP COMPANY.—The prospectus of a new steam ship company that has been formed in Madras under the style and title of the South Indian Steam Navigation Co. has just been issued. The company is composed entirely of native gentlemen of Southern India, the "moving 'spirit," according to a local paper, being Dr. Dhanakoti Raju, M.D. We also learn that Dr. Dhanakoti, who has recently returned to India from an extended tour in Europe, has been "sedulously engaged in organising and adopting suitable measures for developing and strengthening one or two industries which he had previously started, and especially the manufacture and export of salt from his salt works at Kayalpatam and Kolasegarapatam, on the south-east coast of Madras." The prospectus states:—The company proposes to establish a line of small steamers and a regular weekly service between Kolasegarapatam and Cudalore, *viâ* the Pambam Pass, and between Kolasegarapatam and Colombo. The pioneer steamers already secured for this purpose are the *Bheema* and the *Krishna*, of exactly the same size, dimensions and description which have been specially designed for traffic on the Indian coast and for native passenger traffic. Both the steamers are provided with comfortable deck accommodation, and are lighted throughout with electric light. They are also provided with best sanitary arrangements. The two steamers have each a cargo space capable of holding upward of 400 tons of goods, besides comfortable accommodation for about 600 passengers. They have also a limited first-class cabin accommodation. The steamers of the company will call at the Kolasegarapatam, Koyalpatam, Tuticorin, Keelakari Pambam, Tondi, Negapatam, and Cudalore and Colombo, and, being of light draught, will be able to get quite close to the different ports, and will therefore be of great convenience and advantage to passengers and shippers of goods. The steamers are under the command and direction of duly qualified, certificated, and experienced native officers and professional men. The company, having a large interest in the manufacture and export of salt produced in some of the ports touched by these steamers, as also in the import of food grains, the steamers will be largely employed in the transport of these goods. The first steamer, the *Bheema*, will commence to run between the eastern ports about the second week of June.—*Madras Mail.*

ALUMINIUM.—We have received from the Alliance Aluminium Co. a booklet containing a whole compendium of the uses of aluminium and its alloys. In it the history of the discovery of this metallic base is graphically given, and from the first discovery of Lavoisier in 1754, to Wöhler's first obtaining *metallic* aluminium in 1824, the efforts of various experimenters, especially Deville, were rewarded with more or less commercial success. With the assistance of Napoleon III. Deville investigated and developed Wöhler's original experiments, and was rewarded by that august personage when he had obtained aluminium in minute beads by heating chloride of aluminium and sodium with two bars of the metal. It is interesting to know that every common brick contains from two to three pounds of aluminium, and that the raw material—containing this very capricious metal, forms one of the chief constituents of the crust of our earthly world. Aluminium on first discovery, and long afterwards, took precedence of gold in price, and even now the two metals may be seen combined in the links of chains that decorate the ample waistcoats of our City fathers and even of their juvenile sons. From being about £5 an ounce the Alliance Co. can now produce exactly the same metal by the NETTO process, which is their speciality at Wallsend-on-Tyne, at a price something like under *one shilling per ounce.* It is a curious fact that the mineral cryolite, which forms, as a raw material, the principal feature in this company's production of aluminium, is only found in one part of Greenland, but the deposit there is supposed to be of such an extent that little danger exists of its being soon exhausted. The company have acquired patents and manufacturing secrets for the production of pure aluminium from this mineral, for the wholesale manufacture of sodium, and for the conversion of the scoriæ produced into cryolite, and they are, by special agreement, working the only known cryolite mine. To produce *one* ton of aluminium, 12 tons of cryolite, 12 tons of common salt, 12 tons of coke, for heating, and 8 tons of sodium are required. No wonder aluminium is dear.

NEW DREDGER FOR THE JAPANESE GOVERNMENT.—The patent hopper dredger *Ayame*, constructed by Wm. Simons & Co., Renfrew, left Greenock on July 3rd, for Yokohama. This vessel has been supplied to the Japanese Government, in connection with extensive harbour improvements at that port, and is of the same type as the *St. Patrick*, recently supplied to the British Government, and fitted with the builders' latest improvements. The engines are triple expansion, and on the measured distance at Gareloch, (when vessel was fully loaded) a mean speed of nearly 1½ knots in excess of the contract was obtained, six runs being taken with and against tide. The dredging and other portions of the machinery was tried, and everything found to work in a most satisfactory manner.

Landing for Ocean Steamers at Liverpool.—For some time there has been an outcry at Liverpool against the obligation of passengers by ocean steamers either going ashore by means of tenders, on which they are often inconveniently crowded, or losing time by waiting until the huge vessels can be taken into dock. A demand has consequently developed for the provision of a landing-place whereat passengers may disembark from ocean steamers promptly without the help of tenders. Mr. Joseph Boult, C.E., has prepared a sketch plan with suggestions for meeting this demand. His proposal is to form a new harbour at the extreme north end of the Liverpool dock estate by projecting a breakwater from a point near the Seaforth Battery to a point about 300 yards from the Canada entrance. The greatest width of the harbour enclosed by the breakwater would be 400 yards, while the entrance at the south end would be 250 yards wide. Inside the breakwater Mr. Boult would moor a pontoon stage of sufficient length for four steamers, each 600 ft. long, to lie alongside. On the top of the breakwater he proposes that a railway shall run in connection with the London and North-Western, the Midland, and the Lancashire and Yorkshire lines, which run down to the docks. With the help of floating shields he would provide comparatively smooth water, even in stormy weather; while, if necessary, the present depth of 25 ft. at low-water spring tides might be increased at moderate expense. Thus steamships could disembark their passengers at any state of the tide; and the passengers could, by means of floating roadways, reach the trains awaiting them at the breakwater, and the vessels, having landed passengers and mails, would be in good position for being taken into the Langton, Alexander, or other north docks, which are just behind the proposed new harbour.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from June 15th to July 15th, 1890.

9276 C. D. Austin. Sight feed lubricators.
9282 A. G. Brookes. Direct-acting engines (C. C. Worthington, U.S.A.).
9300 J. Marshall and R. Wigram. Slide valves.
9572 J. Hannan. Valves and ports of steam-engines.
9664 E. Leslie. Slide valve.
9697 H. D. Brandreth and J. Taylor. Ships.
9764 J. L. Garsed. Propellers of steamboats.
9766 E. W. Sargeant. Pumping machinery of steam vessels.
9769 H. Butterfield and W. Fox. Lubricators.
9832 E. Hoyle. Steam-engines.
10015 G. E. Belliss and A. Morcom. Steam boilers.
10045 W. W. Horn. Filter and heater for steam boilers (W. Dougherty, U.S.A.).
10055 F. E. Blackmore. Steam traps.
10099 H. Kimball Jones. Propellers.
10163 J. S. Raworth. Steam pumps.
10164 R. G. Brooke. Injectors.
10168 J. L. Lowry. Steam pumping engines.
10185 H. H. Lake. Propulsion of vessels (The American Marine and Canal Screw Propeller Co., U.S.A.).
10190 A. H. Thorn. Combined boat equipment.
10215 G. Duvinsge. Equilibrated slide valves.
10292 P. Robertson. Marine engines.
10300 J. Proctor. Mechanical stokers.
10317 J. Tyler, G. Meacham, and W. A. Blandford. Governors for marine engines.
10338 H. Grafton. Steam-engines and governors.
10368 G. W. Newall. Apparatus for maintaining and increasing the effective energy of steam or other motor fluid during its evolution through the pipes of expansion engines.
10379 J. Gilmore. Distilling sea water.
10560 W. Z. Gaffield. Propeller shafts.
10613 P. Robertson and A. D. Wedgwood. Marine engines.
10643 F. H. Ashbury. Steam boiler.
10733 J. Haas, jun. Propeller screws.
10854 C. Scott and H. Hodgson. Operating valves of steam-engines.
10858 J. E. Weyman. Slide valves of steam-engines.
10861 W. H. Greenwood. Boilers and furnaces.
10885 S. Green. Boiler level indicators.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

Extra First Class.

July 19th, 1890. Boyd, Arthur.......... Extra 1C Liverpool

June 28th, 1890.

Barnett, Wm. ..	2C	London
Cleugh, Andrew	1C	Sunderl'd
Crawford, G. A.	1C	N.Shields
Easter, S. H. ..	2C	,,
Ellerington, Jno.	1C	Sunderl'd
Hawes, Wm. ..	2C	,,
Henderson, Alex.	2C	,,
Hindmarsh, M.	2C	L'pool
Hunter, R. J. ..	1C	Sunderl'd
Jackson, C. A...	2C	,,
Kean, Alfred ..	2C	London
Legat, C. E.....	2C	N.Shields
Lloyd, Joseph P.	2C	L'pool
Matthews, W. H.	2C	N.Shields
McKinty, Saml.	2C	Liverpool
McLauchlan, Jn.	2C	,,
Richmond, Wltr.	2C	Sunderl'd
Smith, Matthew	2C	N.Shields
Taylor, Timothy	1C	Sunderl'd
Tully, Andrew	1C	,,
Turtees, Edmd.	2C	,,
Tweney, Wm. E.	2C	London
Wetherall, Thos.	1C	Sunderl'd
Wilson, David..	2C	London
Wilson, Robt. M.	1C	L'pool
Yates, Edmd. P.	1C	N.Shields
Young, James ..	1C	London
Weir, C. C.	2C	Greenock
Whincop, W. N.	1C	L'pool
Williams, Thos.	1C	Cardiff
Whyatt, W. B.	2C	,,

July 5th, 1890.

Aiken, Thomas	2C	Hull
Allan, Wm.	1C	Glasgow
Appleby, Geo. A.	1C	Cardiff
Burns, W. McG.	1C	Greenock
Burton, C. D. ..	2C	London
Briggs, C. H. E.	2C	Cardiff
Cameron, Daniel	2C	Greenock
Clarke, William	2C	,,
Corvan, Thos. ..	2C	L'pool
Cottrell, John H.	2C	London
Cronqvist, C. M.	2C	,,
Fairweather, D.	1C	Greenock
Frederick, John	1C	Cardiff
Godwin, S. Edm.	2C	Dublin
Gregg, Wm. L.	1C	Greenock
Higgins, Thos. B.	2C	Glasgow
Hill, John B. ..	2C	,,
Hewet, Thos. F.	2C	London
Jones, Edwin H.	2C	Cardiff
Knapp, Wm. L.	1C	,,
Lindsay, Andrew	1C	London
Lion, James....	1C	,,
Lyle, Robert ..	2C	Glasgow
McDougall, Arch.	1C	,,
McEwan, Thos.	1C	,,
McMillan, J. H.	1C	Greenock
McPherson, Dld.	1C	Belfast
Mead, Andrew	2C	London
Menzies, Alex. M.	1C	Greenock
Murray, Andrew	2C	,,
Penny, Joseph	1C	Glasgow
Reid, Robert ..	1C	,,
Robinson, Jos. ..	2C	Cardiff
Robertson, Wm.	2C	Greenock
Rores, Geo.	2C	L'pool
Sayle, John T.	2C	,,
Shaw, James ..	2C	,,
Shay, John	2C	Hull
Sinclair, Rodk.	2C	Glasgow
Stewart, James	2C	London
Stokes, Percy ..	1C	L'pool
Swaine, Wm. E.	2C	Dublin
Thomas, F. Wm.	2C	Cardiff
Thomson, H. T.	2C	Glasgow
Towers, Walter	1C	,,
Watson, James	2C	,,

July 12th, 1890.

Adamson, Frank	2C	W. Hrtlpl
Anderson, Thos.	2C	Leith
Barry, George ..	1C	L'pool
Blackie, Walter	1C	,,
Bond, John	2C	,,
Briggs, Thomas	2C	W. Hrtlpl
Burge, C. R. W.	2C	N. Shields
Cowan, Wm. ..	2C	Leith
Fraser, Chris. ..	2C	,,
Henderson, Ed.	2C	W. Hrtlpl
Hunter, Arth. S.	2C	,,
Irvin, John Jas.	2C	,,
Johnson, Jno. W.	1C	L'pool
Kettles, John ..	1C	Leith
Lloyd, Geo. C.	1C	,,
MacIntosh, D.	2C	,,
Maulden, Ern. G.	2C	N. Shields
McArthur, Wm.	1C	Leith
McLaren, Geo.	2C	,,
Milburn, J. W.	2C	N. Shields
Morison, Jno. D.	2C	Leith
Muir, E. C.....	1C	London
Orr, Jno. Wm.	1C	N. Shields
Philpott, R. B.	2C	Leith
Rose, Wm. H.	2C	,,
Ray, Jas. Wm.	2C	N. Shields
Scott, Fred D.	2C	Leith
Stevenson, Ern.	2C	L'pool
Stewart, C. A.	2C	Leith
Swan, Jno. Edg.	2C	,,
Sykes, James E.	1C	L'pool
Taylor, Adam..	2C	Leith
Triplett, Thos.	2C	N. Shields
Warburton, G. W.	2C	,,
Wickham, Hy.	1C	Leith
Wilson, John ..	1C	L'pool
Wilson, Fdk. W.	2C	N. Shields

July 19th, 1890.

Anthony, J. D. C.	2C	Cardiff
Atkinson, W. G.	2C	London
Biggam, Chas.	2C	Liverpool
Burston, Chs. W.	2C	Cardiff
Daniels, Hy. A.	2C	London
Dixon, H. T. G.	1C	Cardiff
Dukes, George	2C	Bristol
Dunn, Robert	2C	Dundee
Foggo, George T.	1C	L'pool
Forsyth, Mark	2C	Dundee
Gover, Joseph..	2C	London
Hall, Bird	2C	,,
Hughes, Wm. R.	2C	Glasgow
Manning, G. R.	1C	London
McDonald, Alex.	2C	Glasgow
McGinty, James	1C	,,
McLeod, D. B. ..	2C	London
Middlemass, W.	2C	Glasgow
Moffat, H. W. ..	2C	,,
Moore, Wm. Alf.	1C	Cardiff
Paxton, Harry S.	1C	Dundee
Roberts, R. Sam.	2C	Cardiff
Robertson, W...	1C	London
Smith, James G.	2C	Dundee
Smyth, Robert	2C	London
Thomson, J. M.	2C	,,
Thomson, Peter	2C	Dundee
Thomson, Wm.	2C	,,
Torrie, James ..	1C	Glasgow
Tulip, George..	1C	N. Shields
Young, John ..	2C	Glasgow

The Marine Engineer.

LONDON, SEPTEMBER 1, 1890.

RECENT discussions in Parliament have drawn attention to our latest naval and military inventions and the compensation paid to inventors for their use. Amongst these latest inventions is the "Brennan Torpedo," which differs from any other at present in use, such as the "Whitehead," mainly in the arrangement that, whilst the "Whitehead" torpedo is self-contained and propelled by a charge of compressed air without other guidance than that of its first impulse, the "Brennan" torpedo is arranged so as to be under complete control from the point from which it is discharged. In this case, however, as the motive power is derived from a stationary centre connected by light wires, it is not considered that it will have any wide application on board ship, but it is considered that it will prove of great value for adaptation to the defence of harbours and ports, being worked from a central station on land. The H.P. of the stationary engine is nearly 100 in value, which drives two large drums about 4 ft. in diameter, and winds thereon at a high velocity two extremely strong and fine steel wires. These wires are unwound from two small reels, fitted in the body of the torpedo, and the rapid motion of the reels is communicated to the propellers sufficient to give the torpedo a speed at the rate of about 26 miles per hour over a course of about 3,000 yds. As a consequence of this arrangement the torpedo is always in constant communication with the dispatching centre station, and as the speed of either winding drum may be varied at pleasure by the operator, the speed of one of the screws as compared with the other may be varied from the shore, thus enabling the torpedo to be steered with extreme accuracy in either direction, long after she has left the hands of the operator. This invention, it is hoped, will be of such a deadly character, when worked from the shore, as will prove an ample protection to our ports in place of fortifications, and will thus save perhaps some millions to the country. Mr. Stanhope invited a large party of Peers and Commons in the early part of this month to witness some experiments with the "Brennan" torpedo, which have passed off most successfully. The special service vessel, *Sea Horse*, towed an old collier brig, apparently about 400 tons burden, across the torpedo station, which she passed at about ten knots. When nearly abreast the station the torpedo was discharged, and proceeded across the Channel at what emed an enormous velocity. The course of the torpedo was rendered obvious by a tiny blue-and-white flag carried just above the level of the sea at the top of a light steel mast. The torpedo seemed to have been directed a trifle too far astern, but was observed to take a sharp turn to port, and successfully struck the brig under the steering guidance from the shore. There was a dull sound of explosion and a column of spray and coal dust was thrown up. The hulk began to settle down at once, and, in certainly not more than a minute, no vestige of her remained above water. This was evidently a most successful experiment, and very much to the credit of the operator. The weather conditions may have been considered essentially favourable in war time, but might have been better for mere exhibition purposes. The whole experiment seems amply to have defined that we are in possession of a defensive weapon of the most deadly character, which may well be considered a substitute for the expensive fortifications so much advocated by some authorities for the adequate defence of our exposed ports and arsenals.

SOUTHAMPTON has had a gala day during the past month, when Her Majesty the Queen visited the port for the purpose of inaugurating a deep water dock. This dock has been energetically carried forward for some years, and has had the usual, if perhaps not more than the usual, mishaps to deal with during construction. The most serious of these was the bodily displacement of a great portion of the east wall, necessitating the rebuilding of 460 ft. out of 800 ft., and involving an expenditure of £40,000. The whole amount spent must therefore have amounted to somewhere about £350,000, but the Port has now acquired a most valuable dock, suitable for the largest merchant vessels. The form of the dock somewhat resembles a diamond-shaped trowel, the handle of which, representing the mouth, being slightly turned to the eastwards. This is quite a new departure in dock design, but is calculated to give the greatest facility to vessels for approaching and berthing most readily, the inconvenient corners, common in most of the old docks, being thus to a great extent avoided. The uniform depth is 26 ft. at low water spring tides, and the water area available is 18 acres. A continuous channel two miles long, of the same uniform depth, has been dredged from the entrance to the natural channel of the river. The construction has been carried out principally in solid concrete and Cornish granite facings and coatings. There is a complete system of railways throughout the dock property, extending for 15 miles in length, to all quays and into and alongside each warehouse. Although Her Majesty did not land from the royal yacht, Southampton was extensively decorated throughout the principal streets, and the ships in the port were dressed with bunting and the quays were gay with decorations. This appears to be one of the few occasions, if not the only one, in which Her Majesty has so honoured a dock company as to give a name to one of their docks in person. The rise of Southampton into a modern port, with dock facilities for heavy traffic, seems to have taken place within the last generation, as a gentleman present at the after banquet stated he could well remember the time when there were no docks at Southampton, and if there had been, there were no steamships to take advantage of them. The ground seems to have been very unsuitable and unstable for such erections, as the serious disaster to the present dock during erection would testify, but by great engineering ingenuity the difficulties have been overcome, having necessitated the employment of an unusual quantity of iron tie rods, brass straps, &c., to firmly unite the masonry and render it stable. At the naming of the dock Her Majesty's yacht steamed round the dock, and Her Majesty received the Chairman and Directors of the Dock Co. and their secretary and engineer. The dock has been named the "Empress Dock" by Her Majesty, and after reception of the Mayor and Corporation of Southampton, Her Majesty returned to Osborne without leaving her yacht.

THE fact that between fifty and sixty thousand tons of new shipping have, within the past few weeks, been placed with Clyde shipbuilders, is not only matter for gratification so far as that important centre is concerned, but it must also afford satisfaction to the industrial and trading community of the whole country. A resumption of activity in the yards and workshops of the premier shipbuilding centre is one of the most reassuring signs the country can have in regard to the general course of business during the rest of the year. The Clan Line Co., Limited, of Glasgow and Liverpool, have ordered three vessels of between 4,500 and 5,000 tons each from one firm, and the British India Association Co. have placed the orders for three large steamers of over 5,000 tons for their direct service to the East. A Hamburg company have ordered two steamers of large size, and Messrs. Russell & Co., of Port-Glasgow, have booked orders for as many as five sailing vessels of between 1,500 and 2,500 tons each. Messrs. Fleming & Ferguson, of Paisley, have been instructed to build and engine two steam barges for the Japanese Government, and Messrs. Simons & Co., of Renfrew, are to build for the Nicaragua Canal Construction Co. one of their patent hopper-dredgers, with a dredging capacity of 500 tons per hour. Enquiries also continue to be made, and it is known that one, if not two, foreign mail lines are in the market for additional steamers. These contracts have brought about a decided recovery of the general tone of the West of Scotland iron and steel industries. Shipbuilders and boiler makers have been freely laying in stock, and steel rates have all been advanced 5s. per ton, angles now being quoted at £6 5s., ship plates at £7 to £7 5s., and boiler plates at £7 15s. The contracts could hardly have been booked at a more opportune time, for not only have the stocks been assuming a woefully barren aspect, but, as may have been gathered from our Clyde Industrial Notes, indications of coming labour disputes have been marked and plentiful. The orders now in hand, and those which may be well expected to follow, will have the effect of averting any serious disputes and affording workmen continued employment at the present or slightly altered rates.

MANCHESTER SHIP CANAL.

The Manchester and Salford Docks Section.

IN a previous notice with respect to the progress of the Manchester Ship Canal works, we referred to the admirable policy which has been adopted by the directors of inviting representatives of various trades and industries likely to be interested in their undertaking to inspect the improved means of navigation they are providing for numerous inland centres of commerce. Perhaps the most important, and certainly the most significant visit of inspection was that which took place last week, when a numerous party of gentlemen, the majority of whom are directly or indirectly interested in shipping connected with the port of Liverpool, were conducted over the whole length of the canal under the guidance of Messrs. J. K. Bythell, one of the directors, Leader Williams, the chief engineer, and Marshall Stevens, the general traffic manager, representing the Manchester Ship Canal. The party included a large number of members of the Mersey Docks and Harbour Board, and the acceptance of the invitation offered by the Ship Canal Co. to inspect the works which are being carried out, together with the subsequent proceedings, may be regarded generally as an indication of the friendship which is now said to exist between the Manchester Ship Canal Co. and the Mersey Docks and Harbour Board, and which, it is hoped, will put an end to the strong opposition which Liverpool has hitherto manifested towards the undertaking, and to the feeling of jealousy that has existed with regard to the project which has been too much looked upon as a direct attack upon the interests of Liverpool as a port. After a thorough inspection of the whole of the works of the Ship Canal, from Manchester to Eastham, the party sat down to lunch at the Eastham Ferry Hotel, Mr. J. K. Bythell occupying the chair. The speeches which followed were all of the most complimentary and amicable character, "Prosperity to the Manchester Ship Canal Co." being most heartily proposed by Mr. W. H. Tindall, chairman of the visitation committee of Lloyd's registry of shipping, votes of thanks to the chairman and to Mr. Marshall Stevens being also most cordially proposed and supported by Mr. Thomas Wrightson, chairman of the works committee of the River Tees Commissioners, and Mr. H. J. Atkinson, M.P., whilst Mr. James Barrow, on behalf of the Mersey Docks and Harbour Board, in thanking Mr. Bythell for his kindness during the trip, characterised the Ship Canal as stupendous and gigantic, at the same time wishing prosperity to the Manchester Ship Canal, and expressing the hope that the Mersey would be the real and sole channel for the whole of the trade of the North of England. The party returned to Liverpool on board the Dock

Board tender *Vigilant*, a kindly act of courtesy on the part of the board which was evidently intended as a confirmation of the feeling of friendship that has now been inaugurated between the representative interests of the port of Liverpool and the Manchester Ship Canal undertaking. In our last issue we gave some details of the progress of the works on the Eastham section at the entrance to the canal, which, it was stated by Mr. Bythell during the visit of the representatives of the Liverpool shipping interest last week, above referred to, would be completed for a distance of ten miles, and open for traffic some four or five months hence. It will now be interesting to give some details with reference to the Manchester and Salford Docks at the terminus of the canal, a section which is also being rapidly pushed forward towards completion. This section from Manchester and Salford, as far as the Barton aqueduct, has for some time past been a point of interest for visits by various engineering societies of this and the neighbouring districts, the most recent inspection being by the members of the Manchester Association of Engineers, and a description of the state of the works at the time of their visit will afford some idea of the enormous progress which has been made since the commencement of the undertaking little more than two years ago. Entering the works of the Manchester Ship Canal at what is known as the Pomono entrance, by the side of the Bridgewater Canal, the visitors were immediately struck by the appearance of the river, which here has been much altered by a very large and important piling operation commenced in November last year, and continued almost uninterruptedly since. This piling was begun by means of two twin piling machines constructed upon the works, and erected upon two pontoons placed at such distance apart as to give the proper space between the two rows of sheet piles, this space being afterwards cleared of the mud and river water and filled up with clay well puddled in. This piling has still to be continued some distance, many thousand piles being used, but at the present time one portion has been completely enclosed, and the water being drained off, preparations have been made for the deepening of the river and the excavation to the first arm of the Pomona Dock. The three arms of the Pomona Dock average each 571 ft. long; the longest arm, which can be seen running parallel to the river being 620 ft. long. The work of excavating for the walls of the Ordsall Dock, which closely adjoins, was commenced at the end of May this year, and good progress has already been made in the concreting by means of the Cary and Leatham machine. Leaving Pomona, and walking under Trafford roadway, the visitors passed by the old Throstle Nest locks and weir, which, when constructed, attracted a large amount of attention, and under a temporary timber bridge, which, completed in January this year, enabled the contractor to divert the traffic of Trafford Road and combine the excavation for the swing bridge, which at this point is to cross the Ship Canal. Here the concrete pier, upon which the Trafford new bridge will turn, and which with its wings is shaped something like an aborted E with a large centre, is in course of construction, the centre being one solid mass of concrete 60 ft. by 60 ft. by 25 ft. deep, and, with the wings, is estimated to contain upwards of 15,000 tons of material. Crossing the river here by means of the workman's bridge, which is suspended by irons from the present Trafford bridge, the next point of interest was the forward state of the three arms of the Salford Docks, of which the one nearest the river is to be 828 ft. long the next one, 1,177 ft. long, and the further one, nearest the race-course 1,350 ft. long; these docks, together with the Pomona Docks, give an area of water space of 114 acres, with a length of quays of 5¼ miles. Recrossing the river, the party inspected the work going on near the Stretford culvert, where piling machines are busily engaged in driving the first row of piles for the construction of a timber jetty several hundred yards long, where, when necessary, vessels may load or discharge their cargoes. Attention was next attracted to the gate shed, about 300 ft. by 70 ft., where the gates are being constructed for the Mode Wheel and probably the Barton Locks, the largest pair of gates for each of these locks weighing several hundreds of tons. These gates, after being completely fitted together in the shed, are then taken to pieces again and stored until they can be erected again in the position they are to occupy. The timber of which these gates are composed is very hard, very heavy, 10 lbs. per foot heavier than water, and is to some extent poisonous, and yet sometimes, though rarely, there may be seen in pieces here and there the channels caused by some larvæ, which live upon and reach their development even in this hard wood. Leaving this shed, the party came in sight of the first set of locks at Mode Wheel. These locks, with a fall of 13 ft. to Barton, are respectively 600 ft. by 65 ft. and 450 ft. by 45 ft., and are to be fitted with an extra pair of gates, by means of which the lock space may be reduced and water saved if desirable. On the south side of the locks are to be erected four of Stoney's patent sluices, to let off the flood water when desired. The concrete foundations for the sluice piers are nearly ready, and it is expected that very shortly the iron piers, each of them weighing more than 10 tons, will be erected. These sluice gates are said to be so delicately adjusted by means of counterpoise that they require very little power to raise or lower them, even with the pressure of water against them. The large lock at Mode Wheel shows well the stupendous character of this undertaking, and the visitors standing upon the upper gate obtained an excellent idea of the size of the lock, the thickness of the walls, and the apparently intricate character of the waterways, sluice gates, and openings necessary for the rapid filling and emptying of the lock when vessels are passing up and down the canal. Shortly after passing these locks the party came to the first completed portion of the Manchester Ship Canal. This short length of the canal narrowly escaped inundation in November last year, and was completely inundated in January of the present year, the broken bank being afterwards made up by over 2,000 waggon-loads of spoil, and the water pumped out. A fair idea is here obtained of the width and general appearance of the wider portion of the canal. From Manchester to Barton, in this distance of about three miles, the minimum bottom width is 170 ft., with 230 ft. at water level; whilst from Barton westwards the average bottom width is 120 ft., with 172 ft. at water level, and allowing a minimum depth of 26 ft. The next point of special interest was Barton, where Brindley's great work of the past is to give way to this great work of the present and future, and here, as a preparatory step to the construction of the swing aqueduct, the south bank of the cutting, which is in solid sandstone, is being excavated and completely finished, so that the river water may be diverted and the work further prosecuted in the present bed of the river. On the east side of the aqueduct can be seen the pier, built of blue and red bricks, set in cement, with stone nosings, which is to carry, or to assist in carrying, the swing aqueduct; and on the west is a similar pier, to carry the new Barton roadway swing bridge. These two piers, together with the concrete buttresses, have been as rapidly as possible pushed forward, so that there may be no unnecessary delay in diverting the water, which will pass under the aqueduct through the two headings, which are readily seen by visitors. At the present time a very important work is going on at the bottom of this cutting; a gully is being cut beneath the temporary road support, and a heading is being driven under the present river. This will be carefully built of brick, set in concrete, and is to receive the gas and water pipes for this district, and access will be obtained by means of shafts on either side. On the opposite side of the river a commencement has been made in the excavation for piers, from which, placed at regular distances, will spring arches, to carry the eastern wall of the Bridgewater Canal Deviation, the eastern wall of the present canal forming the western wall of the deviation, the interior being filled with clay, well puddled to prevent leakage from the canal.

The following statistics with reference to the canal, and to the plant and number of men now engaged on the work, will be interesting to our readers:—

Total length of the Canal	35½	miles.
Minimum width at bottom	120	feet.
Average width at water level	172	,,
Bottom width between Barton and Manchester (2½ miles) will be increased to ..	170	,,
Minimum depth of Canal	26	,,

Locks.	Size of largest lock in feet.	Intermediate lock, in feet.	Size of small lock, in feet.	No. and size of sluices in feet.	Rise.
Eastham ..	600 x 80	350 x 50	150 x 30	2 20ft. wide each.	..
Latchford ..	600 x 65	350 x 45	..	2 30ft. ,, ,,	16ft. 6in.
Irlam	600 x 65	350 x 45	..	5 30ft. ,, ,,	16ft. 0in.
Barton	600 x 65	350 x 45	..	4 30ft. ,, ,,	15ft. 0in.
Mode Wheel	600 x 65	350 x 45	..	4 30ft. ,, ,,	13ft. 0in.

Area of water space for Manchester and Salford Docks	114 acres.
Area of Quay space	152 ,,
Length of Quays	5½ miles.
Plant and number of men employed by the Canal Co.:—	
Number of steam navvies, including 3 German, 4 French, and 58 Ruston and Procter ..	96
Large floating dredgers	3
No. of locomotives	169
,, of steam cranes	166
Portable and other engines	128
Steam pumps	187
Waggons	5,960
Pile engines	40
Length in miles of temporary railway	213
No. of men and boys	16,361
,, of horses	182

INNOVATIONS IN THE CONSTRUCTION OF RIVER AND CANAL BARGES.

By M. Ritter (Knight) Von Szabel, late Austrian Naval Officer, of Vienna.

THIS innovation consists essentially in an arrangement by which two distinct vessels, on being revolved round their longitudinal axis to an angle of 90°, can be combined into one single duplex-vessel, or, to put it in different words, a larger vessel is arranged so that it can be parted into two halves (called "semi-barges"), which can be used and navigated with equal facility as two distinct vessels, as if combined into one. By the combination of the two semi-barges into one duplex-barge the draft of the vessel is nearly doubled, the ratio existing between the draft of a loaded semi-vessel and the equally loaded duplex-vessels being 5 : 8 (up to 8 5).

The advantage of the invention consists :—

1. In this difference of draught.
2. In the smaller width of the semi-vessel as compared with the duplex-vessel.
3. In the fact that the combination and separation of the vessels can be effected, without the least disturbance of the cargo, in a minimum of time.

It facilitates the utilisation, to the highest possible extent, of the varying conditions and dimensions of canal locks, and rivers.

The transition from rivers to canals, and from larger canals to smaller ones, is expedited by the possibility afforded of, on arrival at the locks, dividing the vessel in a space of a few minutes; of passing with the semi-vessel, singly, the various smaller locks or the shallow canal, after which the two sections may be recombined and navigated again as one vessel. The process of "folding up" the two vessels will of course take longer than that of separation.

On rivers, the channels of which are interrupted by sandbanks and rapids, the same operation may be carried out, thus avoiding the expense and delay necessitated by, perhaps repeated "lightering," *i.e.*, reduction of the cargo.

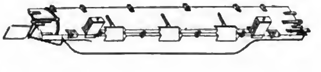
Thus, the through traffic on large rivers like the Danube, with its repeated obstacles to navigation, such as the "iron gate," and several sandbanks known and dreaded by bargemen, would be materially facilitated, any necessity for unloading part of the cargo being obviated; moreover, such a duplex-vessel composed of two semi-vessels affords the advantage of utilising to a fuller degree the power of traction, and one large vessel will be more convenient for traffic than two smaller ones.

Further, the mode of construction of the semi-vessels—both ends of which are of a similar pattern—allows of their being navigated up and down a water-channel without the necessity of turning them round; provision having also been made for the fixing of the rudder at either end, which would therefore merely require exchanging. This is of some advantage in narrow river beds and canals, and applies equally to the duplex-vessel as to the single semi-vessels.

Each semi-barge on its part is also constructed of two equal halves—which are, however, inseparable—and as there is no distinct stem or stern, any one of these semi-vessels will fit any other semi-vessels of the same dimensions, and can be attached to the same by means of the coupling apparatus, and the two "folded-up" into one duplex-vessel. This process does not present any material difficulties; the two single boats on being coupled together can be made to lean over towards each other, by filling their lateral water-compartments, to such an extent that the further closing up can be easily effected by means of specially constructed windlasses. In the case of petroleum vessels the "folding-up" operation is facilitated by the circumstance that the petroleum may be made to serve the purposes of water-ballast.

As regards the size and tonnage of the new vessels, this will of course depend on the local condition of the rivers and canals to be navigated. Thus, a vessel destined for traffic on canals with locks of varying dimensions will have to be adapted to the dimensions of the smallest existing lock.

Fig I.



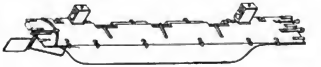


Fig III

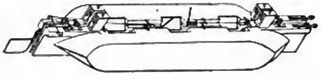


Fig II

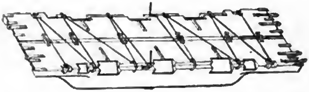


Fig IV

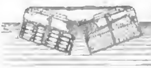
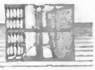


Fig V



Szábel

Supposing the size of the latter to be such as found in the case of the Rhine-Marne, or the Rhine-Rhone canal, or on the Neckar down to Cannstadt, or in the Danube-Main Canal, and some smaller canals in the Weser district, &c., &c., viz.:—

Length of lock..........34·5 metres
Width ,, ... 5·2 ,,
Depth ,, ... 1·6 to 2·0 metres.

The semi barge may be made 32 metres in length, 4 metres in breadth, and 2·5 metres total depth; and with a draught of 1·5 metres will be capable of carrying a load of 100 tons (of 1,000 kilos each). Correspondingly the duplex-vessel will be able to carry 200 tons with a minimum draught of 2·4 metres, and a width of 5·4 metres, but with a favourable height of the water level, the draught of the semi-barge may be increased to 1·65, and that of duplex-vessels to 2·7 metres.

Where not limited to certain proportions by the dimensions of the locks to be passed, the vessel may in the first place be made longer; the width and height may also be increased accordingly (provided that the proportion of breadth to width is kept within the ratio 4 : 2·5), so that the semi-barges may be constructed for a single burthen up to 300 tons, or 600 for the duplex-vessel.

As regards the nature of the cargo, parcels would not be admissible in this instance, but any kind of homogeneous cargo would be suitable, which would bear laying over on one side.

Thus this style of vessel would be well adapted for petroleum tank-vessels, for the transport of all kinds of cereals, flour, coffee, and sugar in sacks—these latter being held in position by an arrangement of planking and boards so as to prevent any overturning of the goods on the vessels being folded up or taken apart, similarly in the case of a cargo of loose grain or other loose produce, the same must be prevented from being upset by a kind of wooden casing.

Two semi-vessels loaded with different cargoes may be coupled together, provided that there is not too much difference between their respective draughts. Slight differences may be balanced by the water-compartments being filled to a greater or smaller extent.

The peculiar position of the hatches allows of loading the semi-vessels separately as well as when coupled together.

If there is for the time being no necessity for using the vessels in their capacity of separate and duplex-barges, any kind of cargo might be loaded that does not require large hatches.

The vessels, on account of their more complicated construction, will be somewhat more expensive, but wherever the advantage offered by them outweigh the extra expenditure, they can be used with success.

The innovation might be of particular importance where a new canal system is being constructed since the latter might be sub-divided into main canals and branch canals—similarly as in the case of ordinary and narrow-gauge railways—the main canal being built of a larger section and with larger locks to suit the duplex-barges, while the branch canals could be planned of smaller dimensions calculated to suit the semi-barge. Thus the first cost of such a canal system would be materially reduced as compared with a canal installation of one uniform section throughout.

Likewise in mountainous districts with rock soil it would be an important consideration whether a canal had to be blasted out of the solid rock or a tunnel cut, in dimensions suitable for a vessel of 6 or of 14 square metres section below the waterline.

In this case, even in certain portions of a main canal—where rendered desirable by the rocky nature of the ground—a smaller section might be adopted, which would only be large enough for single semi-barges, so that the duplex vessel would in these instances have to be taken apart in the same way as in a branch canal.

The saving to be effected by constructing a canal on this principle, as compared with a canal of one uniform section throughout, must be considerable, and the advantages of the arrangement are apparent.

The appended figures will further illustrate the arrangement, Fig. 1 showing two separate semi-barges ready to pursue their journey independently. Fig. 2 shows two semi-barges coupled together ready to be "folded up" by means of ropes and specially constructed windlasses—their lateral water-compartments having previously been filled. Fig. 3 shows the duplex-vessel after the "folding up" operation just described; and Figs. 4 and 5 shows the cross-section of two loaded semi-barges as outlined in Figs. 2 and 3.

These figures, 4 and 5, will also serve to illustrate the manner in which sacks and loose produce should be loaded. Fig. 4 also shows the filled water-compartments, and the effect of their weight in making the boats lean towards each other.

The materials most suited for this new style of vessel will be iron and steels such as generally used in the construction of canal and river vessels.

MESSRS. DURHAM, CHURCHILL & CO.—We have received notice that this well known firm have removed their London offices from 23, Leadenhall Street, to 9, London Street, E.C., to where in future all communications for them should be addressed.

A VISIT TO THE BREMEN EXHIBITION.

THE exhibition, which was opened in Bremen on the 31st of May last, although confined chiefly to the districts of Bremen, Hanover, and Oldenburg, is most interesting and instructive, especially the "Marine Halle," a naval architecture department.

The grounds, which extend over an area of 375,000 square metres, are tastefully laid out, the various exhibits being divided into classes, each in a building for itself. The principal building contains the representative exhibits of the industries of the district, which are numerously represented. In addition are various buildings each confined to one branch of trade or commerce, the foreign trade, machinery, naval architecture, art galleries, architecture and civil engineering, and many smaller private buildings.

The principal entrance, through a quaint old "Bremen Thor" copied from one of the old city gates, is exactly opposite the "Hollersee," a little lake enclosed in the grounds on the other side of which rise the picturesque buildings of the new Park-house and the exhibition. On the lake itself are many rowing boats for hire, and a launch driven by a petroleum engine in which visitors can have a trip for a small sum. The launch has much the appearance of an electric one and runs smoothly; the machinery takes up little room, and can be worked by the man at the tiller with ease, who does not require much engineering knowledge. Passing along the left side of the lake one enters the large quadrangle where, in the evening, the illuminated fountains play. Straight in front is the main building, to the right the "Kunst Halle" (art galleries), and to the left the "Marine Halle" (naval architecture and fisheries). Farther on, crossing the quadrangle diagonally, one approaches the "Handels Anestellung" (foreign trade and commerce), and the old Bremen street. Returning round the back of the principal building are various exhibits of cement work, among others a bridge built entirely from Portland cement, the exhibits from mining and iron works, the "Architectnr Hans" (architecture and civil engineering), the "Maschinen Halle" (machinery house) and the boilers.

"Marine Halle!" In front of the building is exhibited among lifeboat buoys and various other articles the "Bauersches Taucherboot," a most interesting wreck. This is one of the first submarine or diving boats ever built, and was designed by a German naval officer named Baner, who with his companions narrowly escaped suffocating at the trail in Keil harbour. The hull, which is built of iron, contains a large amount of rusted and broken machinery, so much destroyed with lying under water so long that it is difficult to make out how it was originally intended to work. Aft is a rather curious looking old propeller and an iron rudder, which has evidently been worked by chains. The sides and deck of the craft are much damaged, and appear not to have been strong enough to withstand the pressure of water at the depth to which the enterprising designer had descended. This interesting relic of early naval architecture, after lying for years under water, was fished up and preserved as a curiosity by the authorities of the naval dockyard at Keil.

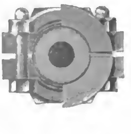
Passing through the vestibule, which is hung round with diving costume and other such articles, the first that one sees on entering the hall are three full models exhibited by the North German Lloyd, of the steamers *Kaiser Wilhelm II.*, *Ems*, and *Lahn*, all well finished with complete deck fittings, also a complete working model of the triple-expansion engine of the steamer *Aller*. Going straight up the main court, which is principally occupied by the Government exhibits, one can trace the rise of the German merchant as well as the Royal Navy. The selection of models here shown by the Government is very complete, comprising not only all the warships, old and new, but representative models of the old as well as new types of merchant ships, making a most interesting study. On the left-hand side of the court are a set of models in section showing the construction of a wooden vessel; the one side is finished and coppered, while the other is shown in frames with a few planks on. On the opposite side of the court a similar set of models from the Action Gesellschaft Weser in Bremen, of the cargo steamer *Africa*, are exhibited, worked in copper to show the construction in iron. This firm have exhibited a large number of models of warships and merchantmen of almost all classes built by them. Two interesting models among their exhibits are a dredger with hopper barges complete in working order, and the large floating sheerlegs built by them for Turkey. The Government yard in Wilhelmshaven have among their exhibits a complete ship's kitchen, hospital, officers' room, and apothecary's shop, as fitted on board the larger men-of-war.

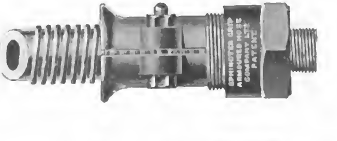
At the entrance to the left-hand court is placed a fully rigged sailing boat, exhibited by Mr. F. Luirssen, boatbuilder, Aumund, which is well finished, built of mahogany, and the mountings all nickel-plated. In this court, which is chiefly set apart for ship fittings, such as ropes, blocks, sails, &c., the North German Lloyd have exhibited a propeller with yellow metal sheathed blades, tail and crank shafts of the mail steamer *Eider*, and in an adjoining room the complete cabin inventory and provisions of the mail steamer *Lahn*. In another adjoining hall are numerous exhibits of electric lighting, as used on board steamships in cabins, holds, and on deck.

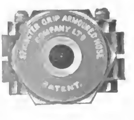
Passing now to the right hand court, which is chiefly occupled with fisheries exhibits and life-saving apparatus, and in the entrance of which is a well-finished and full-rigged model of the barque *J. C. Glade* from the Bremer shiffbangesell-schaft. Now we come to one of the most interesting parts of the whole, the Fisheries division, which is well arranged and tastefully decorated with fishing nets of almost every description. Almost all the different classes of fishing craft used on the German coast or inland fisheries are exhibited, from the large sea-going trawlers down to smallest rowing boats used in catching eels, with their various nets and tackles. A finely finished model of a steam trawler, with trawl net, is shown by Mr. J. Tecklenborg, in Gustemünde, who has built quite a number of this class of boat. Two or three models of sailing boats are shown, resting on glass, as a substitute for water, and the nets stretched out underneath which gives one a clear idea of the working of the trawl-net. In many cases the trawl-net is much smaller than that of the English trawlers, and with differently-shaped hoops on the booms, but otherwise the arrangements are similar. Mr. J. Cölln, Finkenwarder-on-the-Elbe, has shown various fine models of sailing trawlers, and an improved arrangement in fitting the well, which is of great importance to the North Sea trawler, who brings fresh fish to market. Another novelty is an iron sailing trawler with well, ice-room, and steam power for hawling in the big net, a very complete drawing and model of which is shown by Mr. A. Murray, of Vegesack. In an adjoining room are many interesting specimens of fish, oysters, and sea-weed displayed, many of them under magnifying glasses. The exhibition of life-saving apparatus is also very complete and takes up an adjoining hall where the working of the rocket and other systems is very clearly shown. One set of models to the scale of about 3 in. to the foot shows a wreck to which the rocket has been fired and the detachment on land are in the act of landing the first man. Having now completed our round of the "Marine Halle," we will wend our way to the "Maschinen Halle," which, although large, is not what we had expected. This we will describe, along with the few other exhibits interesting to engineers, in our next month's number.

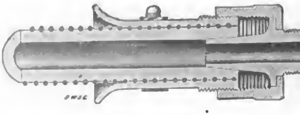
THE SPHINCTER GRIP ARMOURED HOSE.

THIS armoured hose has now been in use for upwards of two years, and has shown itself to be a long way superior to any other previously or now in use. It is the patent of the Sphincter Grip Armoured Hose Co., of 9, Moorfields, London, E.C.; and its peculiarity and strength lies in its *armour*. This consists of a wire wound into a spiral round the rubber hose in such a manner as to grip the pipe so firmly as to resist internal pressure, and at the same time leave no tendency to uncoil. It forms an outer shield to the pipe, which under all circumstances protects it from injury from abrasion when dragged along the ground or from any other rough treatment, and it also materially augments the power of the hose to withstand high pressures. It is quite as flexible as the ordinary rubber tubing, and it possesses the invaluable property of rendering a *kink* an impossibility; and we understand that even, although run over by a cart wheel, no injury to it would follow. It will thus be seen that the flow of water through such a hose must be continuous and of larger volume—in fact it is asserted that a ½-in. sphincter grip will pass in the same time as much water as a ⅝ in. ordinary hose. There is no *inside* coil of wire to interrupt the flow, and there is no oil or any other objectionable preparation used in its manufacture, and it can be cut anywhere without the armour uncoiling, as it is self-holding throughout its entire length. As a steam hose it is invaluable, as it will stand any pressure that in ordinary use might be brought to bear upon it, and when used for hydraulic purposes it is constructed to withstand a pressure on 5 tons per square inch. We understand that this hose has been so much appreciated by shipbuilders, steamship companies, brewers, distillers, dock and harbour companies, &c., that there is now upwards of five million feet of it in actual use. The company have also patented a coupling for their high-pressure hose which is made with a recessed spiral for its entire length so as to fit the outside sphincter spiral wire of the hose. It is made in two parts, and after it is screwed on to the wire armour it is clamped to it by bolts. It is rather an ingenious affair—the body, on the outside, has a screw formed on part of its length, on which is a nut made with a shoulder at one end on its inside, which fits against a corresponding shoulder on a conical or taper pipe. On screwing this nut on to the body of the coupling, the conical pipe is forced into the hole in the centre of the hose, expanding it firmly into the end of the coupling, at the same time making a thoroughly tight joint between the pipe and the hose. The body of the coupling on the outside of the hose is made a little longer than the part of the hose in which the conical pipe fits, so that when pressure is admitted the hose is expanded firmly to the spiral armour, and this again is forced into the corresponding spiral formed in the coupling, thus forming a firm connection between the two, and the more pressure admitted, the firmer is the connection. We give illustrations showing this coupling in elevation and section.









ELECTRICAL ENGINEERING.*

By Mr. R. E. Crompton (Hon. Member.)

Part II.

In my last lecture I brought you up to the point where I had given you a few practical details on the construction and working of the dynamo machines that we used for generating electrical energy, and told you that as a machine for converting energy it has already reached a high point of efficiency, in fact that there is not much more margin left for improvement. I cannot complete the subject of Generating Machinery without reverting to the highly important question of the best means of producing the power for driving it.

Of course any means of producing mechanical energy is useful for driving dynamo machines. Setting aside the most important, the steam engine, we have a choice of gas, hot air, petroleum and hydraulic engines worked by high-pressure water, and where ample water power is available the various forms of water wheels and turbines, but for the present I propose to speak only of driving by means of steam engines. I assure you that the study of the improvements which have been necessary to be made in the engines driving our dynamo electric machines has been one of the largest and most difficult problems that we electrical engineers have had to tackle. The principal requirements in a steam engine intended for driving electric light machinery are the following: 1st. It must be economical of steam. 2nd. It must not occupy much space. 3rd. It must be free from vibration and silent in running. 4th. It must govern well. 5th. It must not only run at a number of revolutions per minute, but also run with sufficient regularity of speed throughout each revolution.

We might divide the steam engines used for driving dynamos into two classes. 1st The older class which are coupled to the dynamos by some form of gearing, whether tooth, frictional, rope or belt driving, so that the armatures of the dynamos can run at a much higher speed than the crank-shaft of the engine: and 2nd. Those engines which are used for direct driving, that is to say, the spindle of the armature of the dynamo and the crank-shaft of the engines are arranged in one line and are coupled to one another, metal to metal. I may say at once that the former class is that which is used for the smaller installations, and chiefly on account of the lower price of the dynamo. I must here explain to you that if you require the same output and the same efficiency, in two dynamos run at different speeds, the cost of the dynamo will be nearly inversely as the speed; that is to say, the 10 unit dynamo of 90 per cent. efficiency that runs at 800 revolutions will cost little more than one-half of one giving the same output and the same efficiency at 400 revolutions, and perhaps it would be well if I here remind you of the cause of this.

In my former lecture I told you that the E.M.F. required to cause a current to circulate in the armature conductors depended on the speed with which these conductors traversed the magnetic field of a given strength. It follows that if the speed be halved, the E.M.F. is halved. You might then ask the question why therefore if I require a slow speed dynamo I do not put a greater number of turns on to the armature, and thus obtain the desired result? My answer is that I can do this, and it is often done; but in order to get the increased number of turns on to the armature, the wire must be of smaller diameter, so that I have not only the increased length and resistance of wire due to the extra number of turns, but I have also the increased resistance of wire due to the fact that it is of smaller diameter, consequently if we take an armature of a given size and put double the number of turns on it, at the same time reducing the section of the wire to one-half, the resistance of the armature to the passage of the current becomes four times what it was before, and therefore the loss and heating in the armature becomes four times as great as before. For this reason when we require a slow speed machine we must considerably increase the diameter or length of the armature, in other words, increase the weight and hence the cost of the machine. The sole reason why the cost of a 400 revolution machine is not quite double that of an 800 revolution machine is that there are certain manufacturing costs and expenses which are common to both sizes of machines, and, moreover, the dimensions of some parts of the slow speed machines may be reduced, as the strains due to centrifugal forces are not so great. I have gone at some length into this subject, because so many of you gentlemen so naturally prefer to use slow speed dynamo machines, and perhaps you have wondered why we makers of dynamo machines are always recommending the higher speed machines, and you will see that it simply arises from the fact that I have briefly stated above, and the desire on our part to give you as much value for your money as possible. Machines that are to be geared to the engines are usually made to run at speeds varying between 600 revolutions and 1,000 revolutions, according to the size of the machine, and they can be made so that they are a perfectly satisfactory job when running at these speeds. No trouble, either with vibration or extra wear of the bearing, or at the brushes need be experienced from causes connected with the speed. Naturally on land we might use any type of steam engine for driving a dynamo machine by gearing, but at sea where space is so valuable, in most cases vertical engines are used. In some cases horizontal engines are used with the cylinder end placed next to the dynamo, so that you can utilise the length of the engine to get sufficient length either for belt or rope driving. I have not space in this lecture to enter into the comparative merits of belt and rope driving and gearing. The subject is an excessively interesting one to my profession as well as to yourselves, and there is a great deal to be said on it, but we find that day by day engineers are preferring to order the larger and more expensive slow speed dynamo, necessitated by direct driving, finding that as soon as a certain size, say 20 units, was reached, the direct driven sets are so much more certain and satisfactory in their driving, and require so much less attention than the geared sets, that in the space of this lecture I hardly think it worth while to take up further time describing the geared sets. Direct driven sets are of two kinds: 1st, the very slow speed sets driven up to 200 revolutions per minute by the ordinary open type of double-acting engine; and 2nd, those driven by a close type of single-acting engine which go to 400 or even 500 revolutions per minute. I have had considerable experience with both classes of engines, but must confess that for land purposes the close type of engine has given such satisfactory results that it seems hardly worth while for the present to pay the greater increased price necessitated by halving the speed of the dynamo in order to revert to the double-acting open type. I have put down a great number of large-sized engines made by Messrs. Willans & Robinson, of Thames Ditton, of the closed type, and both in economy of steam and oil, petty stores and labour, freedom from vibration, and noiselessness, these engines are most remarkable specimens of modern engineering. I shall have great pleasure at some time in showing to the members of this society some of these engines at work in the central stations in London. Another maker of the close type of engines, which has been successfully used on board ship, has been that known as the Bumsted engine. I recently heard that one of these that was fitted on board one of Messrs. Thomas Cook & Sons' Nile steamers is so perfectly silent that it cannot be heard anywhere over the steamer; although being constructed of thin sheet steel, these steamers are exceedingly susceptible to noise, the dropping of a spanner at one end being heard all over the place. I merely mention these two makers, as I have had considerable experience with their engines. No doubt there are others which I have not come so much in contact with that also give good results. I am praising this class, however, thus strongly, because I know that among you marine engineers there is a considerable prejudice in favour of the older type of engines. The objection to the old double-acting type of engine when used for direct driving for land purposes is the great difficulty we find in keeping them perfectly silent, as 180 to 200 revolutions per minute, although very, and uneconomically, slow for a dynamo, is still very fast for the double-acting engine. It is very difficult to keep the brasses in such perfect order that one can hit the happy medium between running hot and knocking. The makers of this class of engine have not been asleep, but have endeavoured to meet this class of difficulties by very perfect design and workmanship, and in many cases they have been very successful. It would be invidious to mention any names. Many of you present will no doubt have been in charge of very beautiful engines of this class. Before I leave the subject of direct driving engines, I must point out the extreme importance of the proper proportioning the areas of pistons of compound engines used for this work. If the right proportion between the cylinders is not hit upon, there is a great tendency to unequal turning throughout the strokes, which makes a most unpleasant effect on the lights, every revolution of the engine being perceptible in the rise and fall in brilliancy of the lamps, and it is quite impossible to get over this fault by increasing the weight of the flywheels. With triple-expansion engines, with cylinders side by side, the difficulty does not appear so great, at least, some of the most regular turning engines of this speed that I have ever seen were triple-expansion engines. An improvement in the direction of simplification, that was introduced partly by my own firm and partly by Messrs. Willans, was the omission of the dynamo bearing next the engine, the armature of the dynamo having a coupling forged or driven on to it, and bolted metal to metal to a coupling at the end of the crank shaft. This intermediate bearing was always a great trouble and cause of heating, and since we have done away with it we have greatly reduced the causes of stoppage of direct-driven sets.

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* Read before the Institute of Marine Engineers.

I have now come to the end of the first part part of my subject., viz., the generation of electrical energy by the dynamo machine.

There are other means of generating electrical energy in addition to the dynamo machine, such as by primary batteries, but for practical purposes it is not worth while discussing them here. You are all familiar with the inventor of various forms of primary batteries, who is going to produce electricity for practically nothing by the large sums for which he hopes to sell the waste products of his battery, but it is needless to enlarge on this subject to practical men like yourselves. Energy cannot be produced in any form without corresponding expenditure of energy, whether from the consumption of fuel or from chemical combinations, which are virtually the same thing. The man who produces his electricity by the consumption of zinc plates in a primary battery is practically using zinc fuel, and a very expensive fuel it is, to take the place of coal we use for driving our dynamo machines through the boiler and steam engine.

I now come to my second part proper, viz.: the utilisation of electrical energy, and I am afraid in the short space of time I have before me, I shall make very limited progress in such an interesting subject. If I were to follow the correct order of things and follow the current away from the dynamo machines, I should have to first describe the conductors and other means of distribution, but I think it will shorten matters if I say that I now propose to describe the lamps for utilising the electrical energy as light, and the motors we use to reproduce mechanical energy for driving machinery. The electrical lamp with which you are most familiar, although it was not first in order of invention, is what is now known as the incandescent or glow lamp. Whether invented by Edison or by Swan it does not matter to us here. Both inventors at an early stage produced the same result, viz.: they have succeeded in obtaining continuous steady light from a short length of the conductor which is raised to a high temperature by the passage of the current through it, by protecting it from the wasting effect of the atmosphere, enclosing it in a glass globe from which the air had been exhausted. All of you are familiar with the present Edison-Swan lamp, consisting of what is called a filament or a thin wire made of carbon attached to platinum terminal wires which are sealed into a glass globe. From this glass globe the air is exhausted by means of mercury pumps to such a high degree of vacuum that the fraction of air that remains may be expressed in millionths of the original quantity. For a long time the great difficulty was in obtaining this perfect vacuum. So long as the vacuum was imperfect the filament did not endure the passage of the current for any length of time. At first it was not quite understood why this should be the case. It was seen that whatever oxygen remained in the small quantity of air left in the partially exhausted globe must be very soon converted into carbonic acid, and consequently the filament could not be wasted any further by chemical action, but it was soon seen that the cause of the wasting was the mechanical effect of the connection currents of the inner gases which remained, these circulating currents exercise a washing or wearing effect on the filament and gradually wear it away. Also so long as any gases however inert remain in the globe, there are always convection currents set up which transfer the heat to the exterior parts of the globe and thus radiate the heat away into space, and all this loss reduced the temperature of the filament and made the lamps far from economical. Now-a-days we can judge the excellence of the vacuum of a lamp by the temperature of the surrounding globe; with a good vacuum the globe is exceedingly cool. If the globes are of fair size you can generally clasp a well exhausted lamp in your hand, but if the lamp is not so perfect the globe becomes too hot to be thus clasped. I have taken the incandescent or glow lamp first in order because it is the very simplest method of producing light by means of electrical energy. As I told you in my former lecture the passage of the electrical current through a conductor always produces heat which is proportionate to the resistance of that conductor. I told you that in the case of the dynamo machine, our object was to waste as little energy as possible in producing heat within the machine itself, or in the conductors which convey the energy to the point where it is to be utilized, but the reverse is the case in the lamps themselves. There we wish to produce light by means of raising a portion of the conductor to an extremely high temperature, and the material that has been best suited for this part of the conductor, and that is now employed in the lamps, is carbon. Although I have mentioned iron and copper, and although you actually can obtain a light from their use, these metals are unsuited for the purpose of such a conducting filament because they melt at a comparatively low temperature and it would be thus impossible to raise them to a temperature suitable for economical light-giving purposes. With platinum wire, or better still, with an alloy of platinum and iridium, useful light effects can be produced, and Edison's first lamps were actually made with this alloy, but now we use a filament or wire of carbon produced by a process of toughening threads of vegetable fibre by partially converting them into cellulose, treating them with various chemical solvents, such as dilute sulphuric acid, sulphate of zinc, cupro ammonia, and similar solvents, and afterwards carbonizing these toughened threads, we are thus able to obtain filaments which can be raised to exceedingly high temperatures, and consequently great efficiency and long life for our lamps. I must here explain what is meant by lamp efficiency. It is the ratio which the quantity of light given by the lamp bears to the electrical energy which is absorbed in that lamp. This efficiency increases with the temperature of the filament, but there is a point beyond which it is dangerous to raise this temperature, as it would considerably shorten the life of the lamp. As the temperature to which the carbon is raised depends on its resistance and on the E.M.F. or pressure applied to its terminals, the makers of these lamps adjust the resistance to such a nicety, that when correct pressure for the lamp (and which is marked on the lamp) is applied to it, then the lamp gives a certain candle power, and the efficiency is obtained by dividing the number of candles of light by the number of watts of energy at the terminals. The lamps you meet with in practice vary between 3½ and 4½ watts per candle. We all of us are in hopes that this efficiency will be increased in the immediate future. At present, owing to the restrictions of the patents, there is little competition between makers in England. On the Continent the case is somewhat different. There we find considerable competition and already the efficiency has risen considerably. You may judge of the importance of this efficiency when I tell you that a rise of efficiency from 4 watts per candle to 2 watts per candle means halving the cost of the unit of light without any change or increase in cost of any part of your generating or distributing plant. The other kind of lamp that is used for utilisation of electrical energy is the arc lamp, which has been often described. The electric arc is the phenomenon which is produced when the current is passed through a pair of carbon points first held in contact with one another, and are afterwards separated to a given short distance. Immediately they are separated, the points of the carbon become heated and disintegrated, and a steady stream either of disintegrated carbon or actually carbon of gas passes between them. These particles being intensely heated give some light, but the majority of the light is given from the points of the carbons themselves, which are raised to a high temperature, far in excess of that of the filament of the incandescent lamp, by the violence of the chemical action which takes place at the surface of the carbon and of the air. The nature of these chemical actions are very complicated, and are not sufficiently well understood for me to enlarge upon them in this lecture. When the arc lamp was first introduced, the light was very unsteady and of bad colour, often bluish and purple, and there were frequent extinctions. As you know in all these points it has been greatly improved. The points in which the greatest improvements were required was in the manufacture of the carbons themselves. These require to be homogeneous, of fine grain, and must be excessively pure, free from any ingredients which melt at a lower temperature than the carbons themselves, and which thus lower the temperature and consequently the light of the arc. A great many people imagine that the great improvement in arc lighting of recent years is due to the improvements in the lamps themselves. I am not quite of this opinion. I believe that very good lamps were made seven or eight years ago, and if these same lamps were used with the perfect carbons we have now, they would give just as good results as the more modern ones. As you know the number of arc lamps is legion. Practically, arc lighting can be and is produced for use in the Navy and for projectors used in the Suez Canal by means of hand regulation. The carbons are held in guides, and when the current is turned on they are in contact; they are then screwed to a small distance apart by a right and left handed screw, and as the carbons wear away under the action of the current, they are brought nearer together by the man in charge turning the hand wheel. Such a lamp requires little thought to understand its action. The case is widely different when we come to the automatic lamps which have to automatically adjust the length of the arc as the carbons burn away. The principle employed in all these lamps is substantially the same, it is that some form of electro-magnet apparatus regulates the feed motion as we call it, that is the progressive motion of one carbon towards the other. Every arc lamp has two separate motions. The first that of what we call "striking the arc," that is, pulling the carbon suddenly apart to the required distance, which is very commonly from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch at the time the lamp commences to burn; the second motion is retaining the points of the carbons the same distance apart. In some lamps the mechanism for these two different duties are kept quite separate. A simple electro-magnet is used to draw the lower carbon a fixed distance from the upper one, which is held in its original position by the second part of the mechanism. The second part of the mechanism consists of the various arrangements of gearing, which enable the descent of the other carbon, generally the upper one, to be controlled by very minute forces, such as those are produced by the change or increase of electric pressure between the two sides of the arc, as it burns away or increases in length. As the arc burns, the carbons waste away, and hence it increases in length, and the electric pressure then required to drive the current across the two sides of the arc increases proportionately. By having a fine wire circuit of high resistance placed parallel to the arc, as this electric pressure increases, the current which passes through this fine wire is increased, and the electro-magnetic effect of this is utilised to work mechanism which allows the carbons to approach one another. The object is to carry out this rather complicated operation with the simplest possible form of machinery. Of the countless forms of arc lamps that have been invented, I am naturally best able to explain to you the one I am most familiar with, viz., my own, which has been in use a great many years, and which is probably a fair specimen of its class. In this lamp the two duties I have been speaking of are performed by one piece of mechanism. The lower carbon is fixed to the frame, the upper carbon is carried by a heavy vertical rod, which is free to slide through guides, so that it can descend and keep in line with the lower carbon. On the side of the upper rod, teeth are cut forming a rack, which can be geared with a pinion mounted on an axis. On this same axis are two large wheels. These large wheels rest on the edges of a lever, and under ordinary circumstances, when the lamp is in action, the weight is borne on the edges of the wheels thus resting on the lever. The lever is held in a given position by a solenoid, which is a form of electro-magnet, having a cylindrical core, which can be sucked into the solenoid as the current round the solenoid increases. You will understand that the core is so placed that as the current in the solenoid—which is the same current which passes through the arc—increases, the core is sucked upwards, the lever is lifted, and the carbons are thus lifted apart. The arc is established, and the lamp begins to burn. In a short time, as the carbons waste away, the electric pressure between the two sides increases. You will see that on the top of the principal solenoid through which the main current passes, is mounted a second solenoid. The length of the core is so designed that as the current is increased in the second solenoid, it opposes the action of the lower solenoid first mentioned. The second solenoid is wound with fine wire, and is permanently connected to the two sides of the arc, so that as the resistance of the arc increases the current through this fine wire solenoid also increases, and as its action is opposed to the action of the first solenoid which lifts the carbon, you will see that the second gradually overcomes the first one and causes the end of the lever to descend. If the arc lamp was only intended to burn for a short time, it would have been possible to have mounted the upper carbon direct on to the core itself, and the regulation of the arc would have been effected through a certain limited stroke, but as we have to use carbons of great length in order to insure that the lamps burn for long hours, the carbon rod is mounted in the way shown. It will be seen that as soon as the upper solenoid has forced the lever down to a certain range, the weight of the carbon wheels and pinion is gradually removed from the rims of the wheels to the finger F, which is placed farther back on the level rather nearer to its fulcrum. As soon as the weight comes on this finger to a sufficient extent the wheels are free to revolve on account of the weight of the rackrod pressing on the pinion. The carbon accordingly descends through a short distance, the current is somewhat increased, and the E.M.F. diminished, the lower solenoid becomes more powerful and the upper one less powerful, as a result the core and lever rises again and the operation is repeated. If a lamp works perfectly there should be no such extended cycle of operations, the lever should descend to what we call the feeding position, and at that position it should be in a state of balance, the wheels slipping round slightly and gradually so as to let the carbons feed together at a given rate. This description of an arc lamp is fairly representative of the great majority of the arc lamps that are actually in use. Although it is complicated to describe, the parts really are very simple. In early days there were many more wheels in these lamps, the object to retard the too rapid descent of the rackrod by introducing a train of wheelwork. The currents most suitable for arc lamps are continuous ones, for this reason that the carbon attached to the positive terminal of the lamp has a crater or hollow worked in it under the action of the current, and this crater becomes much more intensely heated than the point of the negative carbon, and consequently gives off a very large proportion of the total light of the arc. As it is usual to place the carbons nearly vertical with the positive at the top, this tendency of the upper carbon to form a crater is of great use, as it throws a great bulk of the light downwards over a sufficiently large area. With the alternating current there is no such tendency to form craters, both of the points are heated equally, and the light is diffused; just as much is thrown towards the sky as there is towards the ground, and no arrangement of reflectors we can use above the arc to overcome this defect, is half so good as the direct rays from the crater of the positive carbon. When the light is used in a horizontal direction, as needed in the Suez Canal, or on board H.M. ships, for search lights, we get the crater of the positive carbon to one side of it by inclining the lamp, and in addition to that putting the carbons somewhat out of line. In this we get the crater almost at right angles to the line of the beam of light which proceeds from the projector.

I now come to the description of the various modes of distribution of the electric current. For arc lighting, and in some cases for incandescent lamps used for street lighting, where the conductors have to be many miles in length, the lights can be arranged in series with one another, that is to say, the same current passes in succession through the whole of the lamps. I need say little about this here, as this arrangement is at present the exception, and not the rule. It is the best arrangement for arc lighting, as the lamps, one in front of another, steady the lights and this effects a great economy in the cost of the conductors. The great majority of lighting by incandescent lamps, and by such arc lamps as you require on board ship or in our central stations in towns, is on what is called the parallel system, that is to say, the electric circuit consists of two conductors proceeding from the station, along one of which the current goes out, which may be called the flow conductor, and that by which it returns may be called the return conductor. The various glow lamps, or arc lamps, or motors, are arranged in the form of bridges or connections, between these two conductors. The theory of parallel distribution is a very simple one. It is that if the resistance of each lamp is properly proportioned to the current that it will have to carry, the whole system is self-regulating, that is to say, that if the current required by each lamp is one ampere and the E.M.F. 100 volts, that the resistance of that lamp must be 100 ohms, and, as according to Ohm's law, which I have already given you, an E.M.F. of 100 volts will drive one ampere through 100 ohms, it is evident, therefore, that each lamp, as it is switched on, will take its own fair share of current, but this would only be correct if the lamps themselves formed the entire circuit; but as I have already told you, this is impossible to be the case. The dynamo itself, as well as the conductors, form part of the main circuit, and however well they may be designed with an extremely low resistance, this resistance must always be appreciable, and form a perceptible fraction of the whole. It is this resistance of the generating apparatus itself, and of the main conductors, that cause the distribution of electricity to be an expensive matter when the distance traversed by the main conductors is great. The difficulties caused by this waste resistance are two-fold. First, there is a dead loss due to it; and second, the beautiful self-regulating arrangement just described becomes no longer possible. Instead of each lamp receiving exactly 100 volts at its terminals when it is turned on, as each lamp is added it receives somewhat less. At first the fall of pressure may be inconsiderable, but as a large number of lamps are added it becomes very noticeable. In order to compensate for this, it is usual to raise the pressure at the dynamo end of the conductors by running the machinery somewhat faster. If then a large number of lights are suddenly turned out, there is no longer the same loss of pressure in the lamps near home, and the pressure suddenly rises, and the lamps are destroyed from getting too much pressure, hence too much current. A large number of plans have been devised to reduce the loss in the mains. One plan has been to reduce the current as much as possible by using high electric pressure, but there is a limit to the electric pressure we are able to use. In the first place, it is not easy to get lamps with filaments sufficiently long and slender to give as small a light as 10 candles at a higher E.M.F. at the terminals than 100 volts. If lamps could be produced at 400 or 500 volts at the terminals, a great point would be gained. There would be no sacrifice of simplicity of our arrangements, and as the current required by the lamps would be reduced in proportion to the increase of pressure, the size and cost of the mains, and the loss in them would be similarly reduced; but failing the introduction of such lamps, various devices have been introduced for carrying current at high pressure up to various points, and at those points transforming it to currents of low pressure. Such transformation is extremely easy when alternating currents are used, and it is this facility of transformation from high to low pressure, or *vice versa*, which has led to the present great development in alternating current machinery. It will be covering too wide ground to attempt to explain to you the nature of the converter or transformer used for transforming high pressure alternating currents into low pressure ones. The only corresponding apparatus we can use in the case of continuous currents are really pieces of machinery, which consist of a dynamo and motor combined. The motor is driven by a high pressure current, and generates a current of low pressure in the low pressure armature, mounted on the same spindle. Another device, however, is in regular use which has been very successful; that is to say, currents of moderately high pressure are used to charge batteries of accumulators arranged in series, the current is taken off from the terminals of these batteries at any pressure desired. For instance, to make this matter very clear, we may place our generating station at A, and from thence through a line a mile long to B, and from thence another line to C and D and on to E, and from thence home. In each of these stations, B, C, D, and E are placed batteries of accumulators, each consisting of 52 cells, the E.M.F. at the terminals being 100 volts. From the terminals of the batteries are carried the conductors to the adjoining parts of the town, which are lighted from them by 100 volt lamps in the usual manner. Such a plant of distribution, with four batteries in series, is called the five-wire system. A similar plan has been greatly used in America, and is now being used in London, called the three-wire system. In this case there are only two batteries in series. I have only dwelt briefly on these points. The method of distribution to these lamps on board ship presents no special difficulties. The whole of the parts of the ship are such a short distance from the dynamos that the loss in the conductors and the want of regulation, due to the resistance of the conductors, is very slightly felt. On board ship there have been two systems of laying conductors introduced, one called the single wire and the other the double wire system.

At one time the single-wire system was used on land for houses, but it has been forbidden by the Post Office, by the Board of Trade, and other authorities on account of the supposed interference with the operations of the electric telegraphs. Whether rightly so or not remains to be seen. In the case of the single-wire system only one wire is run out from the dynamo, and from it branches are run to the various lamps. The other side of the lamp is connected to the skin of the ship, which again is connected to the dynamo. In the two wire system there is a completely insulated circuit throughout. A pair of wires are laid from the dynamo or switchboard, both of them completely insulated from the ship itself. Both systems have had their supporters and opponents. It is claimed for the single-wire system that it is very much simpler, there are fewer attachments required, and that it is easier to protect the single wire by an armoured casing than it is possible in the other case. In fact the conditions on board ship are widely different from those on land. On land we use nearly everywhere two wires running in grooved wooden casing, and this is what was used on board ship, but it is found that water lodges behind the casing, and even if the grooves are filled in with putty before the covering of the cases is put on, there is still great trouble from the lodgment of sea water. Electrical engineers who have had all their practice in land installations are far too apt to condemn the single-wire system on board ship because they have had bad experience of it on land; but so many good firms are now carrying out good work on this system, and so many engineers claim great advantages for it, that it certainly remains an open question whether it is not quite equal to or better than the double-wire system which has hitherto been supposed to be far superior to it.

Another practical point to which I should call your attention and which may conduce to the comfort or reverse of those who have to deal with electric light installations is the question of what I call the safety fuse or cut-outs, and the position in which these are placed. A safety fuse is a piece of apparatus consisting of a bit of wire that fuses at low temperature inserted in each of the branch circuits, the object being to prevent any great rush of current and consequent heating of that branch wire if accidentally a short circuit is made, that is to say, if instead of the flow of current being limited by the resistance of the lamp or lamps served by the branch wire, there happens to be a temporary connection made direct between the two sides of the circuit. In the case of a single-wire sytem this is liable to take place between the insulated wire, and the ship's side, or in the case of double-wire system between the flow and return conductors, in either case there will be a path of reduced resistance opened and hence a great rush of current, and the smaller branch wire through which the rush of current passes will be overheated and may set the insulation on fire, the fusible wire inserted in each branch prevents this as it melts and cuts off the current long before the copper wire itself is raised to a dangerous temperature. These protective fuses are very useful as a safety device, but also are a great source of annoyance. The lead or tin wire employed usually gets more or less corroded at its contacts with the clips or holes in which it is placed, and high resistance is set in, and the heat due to the resistance of this bad contact may easily melt out the fuse, and therefore put either the single light, or the group of lights served by it, out of service. Most of these fuses, or cut-out boxes as they are sometimes called, are arranged so that it is very easy to insert a fresh piece of wire, but of late years a very good plan has been introduced of grouping of the whole of the cut-outs together at various points of easy access, so that instead of the man in charge having to go all over the ship to find out where the cut-out for each light is, he has them all under his eye at the entrance of each saloon, or each portion of the ship. We have applied this principle with great success for house wiring, and its convenience is universally acknowledged.

Angier Brothers' Steam Freight Report.—August 23rd, 1890.—Freights during the past fortnight have further improved from the Black Sea, Danube, and Azoff, but otherwise remoain at very unremunerative figures, both outward and homeward. China business is quite stagnant. India rates stand at an abnormally low level, with occasional small fluctuations and few transactions, but promise more demand and increased prices for autumn. Azoff, Black Sea and Danube have done a very large trade at gradually improving figures, and continue to absorb all tonnage offered, but unless other trades lend further support than at present the supply of tonnage is likely to break down these rates. Mediterranean work is very poor. Baltic grain rates are kept down, but for deals there is some improvement. The American markets offer no attraction. Grain freights hardly exist thence, and for cotton the demand is slack at easier prices. From the River Plate a few cargoes have been fixed at 1s. 6d. to 2s. rise. Brazil business is restricted to liners. Outward rates are a shade better, but still too low to leave a profit. Bunker coals keep very dear. Wages are high, out of proportion to freights. Insurance and stores are higher. The enquiry for new steamers has fallen off lately, but several builders secured a good share of fresh work during the last two months, and ask more money for further tonnage, whilst some are short of work, and inclined to contract at cheap figures.

THE CAPSIZING OF THE BARQUE "J. C. GLADE."

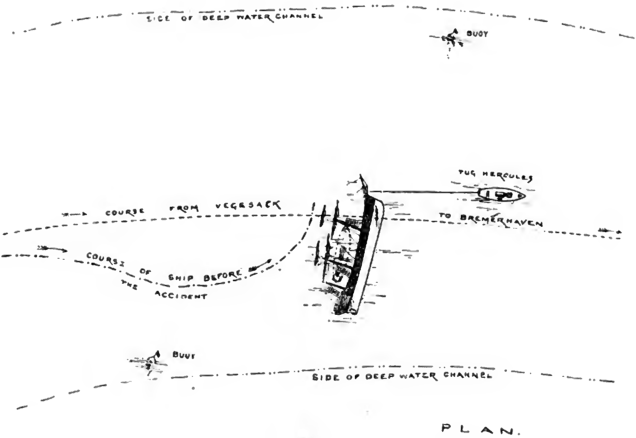
A DISASTROUS accident happened on the Weser lately. The new barque, *J. C. Glade*, while being towed from the builders' yard in Vegesack to Bremerhaven on the 30th of June, by the tugs *Hercules* and *Solide*, was caught in a squall almost opposite Hammelwarden and capsized in the middle of the stream.

The vessel, which was rather crank, had about 50 tons of ballast on board, and the royal and top-gallant yards taken down, which, in the opinion of the builders, were sufficient precautions for the safe transport down the river. All went well for the first hour or so, but then, as the wind grew stronger, the vessel is said to have lurched two or three times heavily, always, however, regaining the upright position. A little above Hammelwarden the deep water channel in the river takes a slight bend, where the barque, failing to answer the helm properly, as ships often do when so light, swayed across the stream. Just at the same moment, as ill-luck would have it, a heavy squall came down laying the vessel over considerably, which, with the united efforts of the two tugs to bring the vessel back to her course, and the strength of the steam under the keel, proved too much, for in about fifteen seconds the magnificent vessel lay flat on her side with the tug *Solide*, sinking under the weight of the broken mainmast and rigging. Fortunately, the tug did not sink directly, but floated for a short time flush with the water, sinking as the tide fell. This short pause enabled the engineer to blow off and put out the fires, thus saving the boiler and preventing an explosion, which would have considerably increased the damage to both tug and barque. The vessel lies in rather a bad position, and will most likely be found to have been considerably injured; the masts will be entirely useless, the mainmast being broken in two places. The yards, however, appear to be still quite good, as also a few other parts of the rigging. At low water the keel of the barque is about 8 ft. above water, and the funnel and wheel-house of the tug are to be seen. Although great excitement ensued on board, the whole of the crews of both tug and barque were rescued (with no other discomfort than a fright and a cold bath) by the prompt assistance rendered by the tug *Hercules*.

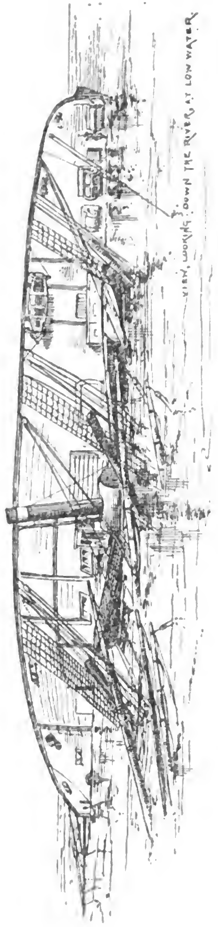
From the sketches, published herewith, one can form a fairly clear idea of the aspect presented by the sunken vessel as she lay on her side half under water.

She was lying, as shown in sketch No. 1, almost across the stream on her port side, with her deck against the current, which had driven quantities of sand and mud into all accessible corners, both of the barque and tug lying under her, and appeared to have fallen through an angle of about 100°, in fact, as far as her masts would allow her. The mainmast, which had fallen across the tug *Solide*, is broken in two places, about five feet above deck and again at the bracket hoop for mainyard; the bulwarks and deck fittings of the *Solide* are broken and crushed. The whole has a forlorn appearance.

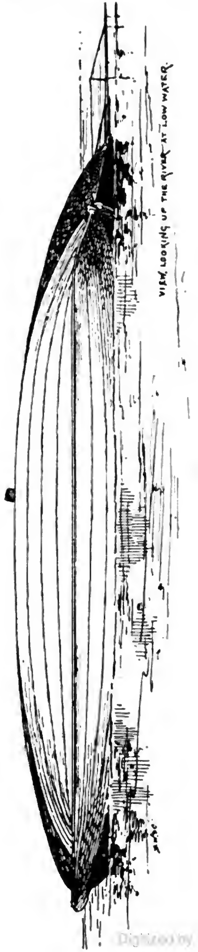
From all appearances, the builders have not allowed themselves enough of margin in stability, for the vessel should, according to contract, have been stable enough, with not more than 50 tons ballast on board to be safely transported from the building yard in Vegesack to Bremerhaven, where she was to be delivered; which has certainly not been the case. That amount of ballast was delivered by the owner in 500 sacks of salt, in order to prevent the delay caused by unshipping the ballast and cleaning in Bremerhaven. As that, however, was not considered enough, all the heavy movable parts of the outfit chains, reserve anchors, filled water barrels, royal yards, &c., were stored in the hold, while the upper top-gallant yards were laid on deck. This still seems to have been too little, for many experienced persons spoke of the undertaking as foolhardy; for the barque laid herself over with little pressure and even lurched when the gangway was withdrawn. The first part of the journey went well, but when the wind freshened and became a little squally, the vessel is said to have behaved not in the best of manners. From what came to light at the examining of witnesses before the "Seeamt," or naval court, it appears the barque had not answered the helm properly, showing a consider-


SIDE OF DEEP WATER CHANNEL
BUOY
TUG HERCULES
COURSE FROM VEGESACK
TO BREMERHAVEN
COURSE OF SHIP BEFORE THE ACCIDENT
BUOY
SIDE OF DEEP WATER CHANNEL
PLAN.

No. 1.


VIEW, LOOKING DOWN THE RIVER, AT LOW WATER.

No. 2.


VIEW, LOOKING UP THE RIVER AT LOW WATER.

No. 3.

able tendency to run into the wind, and that had greatly increased the effect of the squall, which came from a south-easterly direction, nearly eight points of the compass from the direction of the wind a short time earlier. As soon as the squall struck the barque, she laid herself very dangerously over, and swinging round, got the full force of the stream athwartships under the keel, which, followed by the shifting of the ballast, completed the work of destruction. She rested for a few seconds much inclined before the ballast shifted, during which time the pilot endeavoured, with the aid of the two tugs, to bring her back to the course, but on seeing that the barque fell farther, gave order to let go. The captain of the *Solide* said that during the squall, which did not appear to him to be extra strong, the barque heeled far over, and while the two tugs were endeavouring to bring her back again to the course, he heard a considerable noise in the hold, immediately after which she suddenly fell and sank slowly. The whole disaster, including shifting of ballast and falling, did not last more than one-and-a-half minutes. The court expressed the opinion that the accident was principally due to the squall, but could well have been prevented had the director of the yard taken more ballast or other precautions for safety.

The next day the work of clearing away wreckage and preparing for lifting was at once commenced; for which purpose two large fishing-smacks and a number of barges were towed to the spot. The smacks were moored as near as possible to the masts, and work was at once commenced to take away the yards and other light parts. That work proceeded fairly rapidly, and soon the broken mainmast and yards, &c., were all cleared away. On Tuesday, the 8th July, the tug *Solide* was got out and towed, supported by two barges, to Bremerhaven, where it was docked. There the damage, which is not so great as at first expected, was found to be confined chiefly to the deck fittings and what mud and sand could spoil below. In the short time almost two feet of sand and mud had gathered on deck. Now that the wreckage was cleared away work was at once begun to raise and right the larger vessel. The arrangements can well be understood from sketch No. 4. With the assistance of the large floating crane from the new harbour in Bremen, five heavy crutches were erected on the keel and made fast on deck with chains; from these again were hung heavy beams as a counterweight. The crane was then placed near the foremast, on which it was fastened for heaving. Then when the ship had been pumped out by large centrifugal pumps supplied for the purpose, heavy towing hawsers, made fast on the deck and masts, passed over the forks of the crutches on the keel to six tugs completed the arrangements. As the tide began to rise the work was commenced, proceeding so rapidly that in about a quarter of an hour the masts stood at about an angle of 40 deg. to the surface. Here a pause ensued, the position of the crane requiring to be changed to take a fresh purchase. The work then proceeded slowly till the barque stood at about 60 deg., when, with the sail well out of the water, she swung round into the stream, thus rendering the tugs almost useless. The work was then given up for the night; the barque lying in the middle of the stream, supported by the crane on the port side. Next day, after being again pumped out, the vessel by degrees regained an almost vertical position.

On Saturday, the 12th July, or about twelve days after the accident, the *J. C. Glade*, supported on either side by a barge and with a slight list to the port side, was towed safely back again to the yard of her builders to be refitted and repaired. On examining the hull no serious injury was discovered, thanks to the soft bottom of the Weser. The bulwark, as was to be expected, has been stoved in, and the deck and cabin fittings more or less destroyed, but the hull itself seems uninjured, not even slight leakage is discoverable.

The repairs and cleaning are being pushed on as fast as possible, and it is expected that the barque will again be ready for sea in a few weeks. The mainmast must be renewed, and the others taken out for cleaning. Almost all the internal fittings on the port side, sparring, ceiling, cabin arrangements, &c., must be removed, in order that the plates and frames may be thoroughly freed from the mud, slime, and dissolved salt that has found its way into almost every corner.

THE American Government has given out a contract for erecting a lighthouse on the Outer Diamond Shoal, off Cape Hatteras, a most dangerous spot. The cost is £87,000, and the work will be commenced soon.

THE TRANSATLANTIC RECORD BROKEN.

THE White Star liner *Teutonic*, built by Messrs. Harland & Wolff, Belfast, has, after exactly one year's steaming, broken the Transatlantic record, accomplishing the voyage from Roches Point to Sandy Hook, outside New York harbour, in 5 dys. 19 hrs. 5 min., which is 13 min. less than the last fast passage completed by the *City of Paris* on August 28th last year. The *City of New York*, sister to the Inman liner named, gave the pace to the *Teutonic*, and also made the best performance in her two years' steaming, beating the last fastest run by 3 hrs., being only about 3 hrs. behind the *Teutonic*—her time on the passage just completed being 5 dys. 22 hrs. 7 min. Both vessels left Liverpool with the same tide on Wednesday, August 6th, and sailed from Queenstown on Thursday afternoon within an hour of each other, the *City of New York* leading the way. The times of departure, being close, were carefully noted, for although the owners in such circumstances discourage, in a pronounced manner, the racing of the vessels, the knowledge that each vessel will do her best, consistent with safe navigation, the public associate the passages with a race. Indeed, it is said that on Liverpool Exchange betting was freely engaged in. The two vessels were signalled off Sandy Hook on Wednesday morning, August 13th, the *Teutonic* at 5.30 a.m., and the *City of New York* about 7 o'clock. This is the fourth breaking of the record since 1888, and in the following table, we include the *Etruria's* record made in 1888, to show the progress made in Atlantic steaming:—

		dys.	hr.	min.
Etruria, June, 1888	.. ..	6	1	47
City of Paris, May, 1889	.. .. ..	5	23	7
" August, 1889	.. ..	5	19	18
Teutonic, August, 1890	.. .. ..	5	19	5

The *City of New York's* time is quite worthy of being placed on the list, as she has taken the third place on the Atlantic according to the record runs. We give in the following table the daily runs of the best passages recently:—

—	"Teutonic"	"City of Paris"	"City of New York"	"Etruria"
Date of voyage ..	Aug., 1890	Aug., 1889	Aug., 1890	June, 1888
First day ..	473	432	464	455
Second day ..	496	493	486	458
Third " ..	512	502	485	496
Fourth " ..	500	506	474	485
Fifth " ..	485	509	474	503
Sixth " ..	340	346	388	457
Total knots ..	2806	2788	2771	2854
Time taken	5 d. 19 hrs. 5 min.	5 d. 19 hrs. 18 min.	5 d. 28 hrs. 7 min.	6 d. 1 hr. 47 min.

The average speed of the *Teutonic* is fractionally above that of the *City of Paris*, but the latter vessel in some of her other runs has maintained 20 knots. Indeed, the average on three or four voyages was about 20 knots. The *Teutonic*, however, has the credit of the longest day's run on record, three knots further than the *City of Paris*. One point which the figures bring out is the remarkable uniformity of the performance of the latter vessel, but of course there may be some cause to explain why the *Teutonic* dropped from 512 knots on Sunday to 485 knots on Tuesday. It is a decrease in mean speed of from nearly 21 knots per hour to under 20 knots. The *City of Paris* is 560 ft. long, 63 ft. beam, and 43 ft. deep, and of 10,500 tons, the largest merchant vessel afloat in point of tonnage. The *Teutonic* is 582 ft. long, 57 ft. 6 in. beam, and 39 ft. 4 in. deep, and of 9,685 tons. She is the longest vessel afloat, but she is much narrower and shallower for her length than her competitor. The engines in both cases are triple-expansion. In the Inman liner the cylinders are 45 in., 71 in., and 113 in. in diameter, and in the White Star vessel 43 in., 68 in., and 110 in. The pressure in the former is 150 lbs., and in the latter 180 lbs. The propellers in the *Teutonic* overlap by 5 ft. 6 in. The indicated H.P. of the *City of Paris* is 19,000, and of the *Teutonic* 17,000, the proportion of tonnage to indicated H.P. being 1·80 and 1·75 respectively. We have now reached the record breaking period of the year, and good performances may be expected this and next month. One cannot but regret that the *City of Paris* is not now running, otherwise the contest might have been keener; but the remarkable improvement in the *City of New York* may partly make up for this. The steamers from Southampton are doubtless also preparing for good work, and doubtless when the newness gets worn off the *Normannia* she may show the way.

INSTITUTE OF MARINE ENGINEERS.

THIS admirably conducted Institute, being now about to enter on its second winter series of meetings for the reading of papers and discussions on matters appertaining to the marine engineering profession, it may not be out of place to give our readers some idea of the work done by the Institute during the first year of its existence.

The question of having an Institute and rooms, in which marine engineers could meet and discuss the various subjects bearing upon their work, was frequently discussed for some years before the inauguration of this Institute, but no organised scheme had been formulated to meet the requirements of the case. But about October, 1888, several semi-official conversations took place, resulting in meetings being arranged for November of that year, and these meetings finally culminated in the formation of the Institute, and the opening of the temporary premises now occupied by it at the Langthorne Rooms, Broadway, Stratford, on the 1st of February, 1889.

The objects and aims of the Institute were—the social elevation of its members generally; the progressive advancement of its members in a knowledge of the specialities and improvements in machinery as fitted, or proposed to be fitted, on board the steamers of the present or future; the management of original or improved methods of working, or arrangements of machinery to produce better results; by giving its members those opportunities for reading papers leading to an interchange of ideas and experiences which no other existing society afforded; and for publishing and disseminating among its members what was deemed likely to prove useful and beneficial.

Other objects were aimed at for maintaining and improving the status of the profession of marine engineers; founding and upkeeping of a library, recreation, reading, &c., rooms for the use of members, and the founding of a permanent building, in some suitable locality, which would afford home comforts for those of its members when in London, whose homes lay elsewhere.

That these aims have already been so far realized we have only to refer to the very satisfactory first annual report of the honorary secretary, Mr. Adamson, which details the results of the year's work of the Institute, and from which we gather that at the close of the year ending 31st January last the membership had already reached a number far exceeding the most sanguine expectations. We also learn from the same report that the financial affairs of the Institute—that most crucial of all tests—was more than satisfactory.

It is difficult to adequately estimate the power for good which this Institute may ultimately realize, but of one thing there can be no doubt, that it is exercising an elevating tone and a feeling of cordial brotherhood among sea-going engineers, as well as superintendents and owners of our great mercantile navy.

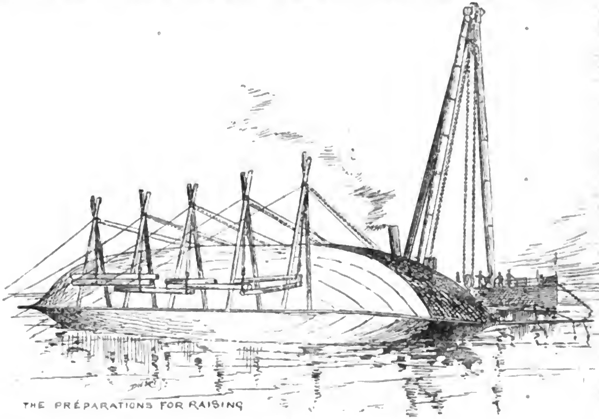
The success of the first year's arduous work is largely due to the late president, Mr. Asplan Beldam, the well-known and genial consulting marine engineer, and to Mr. James Adamson, the hard-working and indefatigable honorary secretary.

The second session for the reading of papers, &c., is expected to be reopened on Friday, the 5th September, by the president, Mr. G. W. Manuel, superintendent engineer of the P. & O. Co., with an address. That evening will also partly be occupied by business, being at the same time the autumn quarterly meeting.

To Mr. W. J. Craig, who has taken so large an interest in connection with the formation of the Institute, is due the credit of designing the crest which the council have adopted as the seal of the Institute, and which heads our present notice, while Mr. J. H. Thomson, as chairman, has rendered great service by his unremitting attention to his duties week by week, and the manner in which the hon. secretary has succeeded in systematizing the whole labour in connection with the affairs of the Institute itself tends to strengthen it.

Mr. J. R. Ruthven, whose name was well known some years ago in connection with water propulsion and the *Waterwitch*, is to read a paper on Tuesday, September 16th, on "Water Jet Propulsion."

The "Transactions" of the first year of the life of the Institute is now issued in the form of a well and handsomely-bound volume, which we recommend to our readers. It will form a valuable as well as an artistic addition to an engineer's library.



No. 4.—*For description see pp.* 239—241.

H.M.S. "ANDROMACHE."

ON August 14th the new fast cruiser *Andromache* was launched from Chatham Dockyard in the presence of a large gathering of ladies and gentlemen, including General Goodenough, the Dean of Rochester, Admiral Superintendent Kelly, Mrs. Kelly and Miss Kelly, Admiral Sir W. Graham, president of the Naval College at Greenwich, and Lady Graham, Captain Andoe, of the Steam Reserve, Mr. Barnaby, Mr. C. T. Glenn, chief constructor of the dockyard, the Rev. J. B. Budds, and Mr. Cock. The *Andromache* is the first vessel launched at Chatham under the Naval Defence Act, though two had previously been launched at Barrow. Four other vessels are also in course of construction at the dockyard—the *Hood*, which is of the Admiral class, the *Hawke*, first-class cruiser, and the *Barfleur* and *Apollo*, which, like the *Andromache*, are second-class battle-ships. The chaplain of the dockyard, Mr. Budds, read the service used on these occasions, and the ceremony of christening the ship was performed by Lady Graham. Nothing could have been done more smoothly and efficiently than the transference of the lofty pile from the dry dock to the water, and the moment the dogshores were dropped the vast bulk began to move quietly, but with gradually increasing impetus, from its cradle into the river beyond. There was no hitch and not a moment's delay.

The *Andromache* was laid down at the beginning of May last year, and as she is in a considerably more forward state, with respect to her internal and topside fittings, than ships generally are at the time of launching, the dockyard may be congratulated on a rapid piece of work. The new vessel is a fast cruiser, and expected to attain 20 knots. She has a protected deck, with 2 in. of armour plate, and 5 in. over the engine hatch. She is built of steel, with plated decks, and the protection extends 3 ft. under water. Her total length between perpendiculars is 300 ft., her extreme breadth 43 ft., her draught of water forward 15 ft. 6 in., and aft 17 ft. 6 in., and the depth of the vessel amidships is 27 ft. The weight worked into the ship before launching is 1,300 tons, but her total displacement when fully equipped will be 3,431 tons, and the I.H.P. is 9,000. The coal capacity is 400 tons, but storage is provided for 635 tons. The engines, which are twin-screw triple-expansion engines, are manufacturing at Earle's shipbuilding yard at Hull, and it is expected that the ship will be finished by March next year. Her armament will consist of two 6 in. breechloading guns, one to be placed on the forecastle and the other on the poop, and the other guns will stand broadsides, and will be six 4·7 in. quick-firing guns, eight six-pounder quick-firing, and one three-pounder, in addition to the boats' guns. She will also be furnished with twelve 14 in. torpedoes, for which four ports are provided, and her full complement will be 253 officers and men.

LAUNCH OF H.M.S. "MELAMPUS."

ON August 2nd the Naval Construction and Armaments Co. launched from their yard at Barrow the steel protected cruiser *Melampus*, built for the Admiralty. This vessel is the second of three second-class cruisers ordered from the Barrow Co. under the provisions of the Naval Defence Act of 1889. It is noteworthy that the Naval Construction and Armaments Co. have now launched two vessels embraced in the naval programme, and that none of the other builders who were entrusted with work for Her Majesty's Government have yet launched their first. The christening ceremony was performed by Lady Muncaster, and there were also present Lord Muncaster, M.P., Lord Edward Cavendish, M.P., and Lady Edward Cavendish, Admiral Morant, Admiral Boys, Mr. W. H. White (Chief Constructor for the Admiralty), Mr. J. R. Thompson (Clyde Bank), Mr. A. D. Bryce-Douglas, and others.

The *Melampus* is one of the new protected cruisers provided by the Naval Defence Act of last year, and is the second of her class launched at Barrow. Her chief dimensions are as follows:—300 ft. long by 43 ft. beam, by 22 ft. 6 in. moulded depth, having a displacement of 3,400 tons on a mean draught of 16 ft. 6 in. Externally the vessel has a very smart appearance, having two funnels and two pole masts with a light fore-and-aft rig. The hull throughout is built of steel. The propelling machinery consists of two sets of triple-expansion engines capable of developing 9,000 I.H.P. The armament of the ship consists of two 6-in. breechloading central-pivot guns, one mounted on the poop and the other on the forecastle; six quick firing 4·7-in. central-pivot guns, three on each broadside; eight quick-firing 6-pounder guns; one 3-pounder Hotchkiss; and four five-barrel Nordenfelt guns. A 9-pounder gun for boat and field purposes is also secured on deck. She is also fitted with four torpedo tubes. For controlling the ship when in action a conning tower of steel 3 in. thick is fitted, inside of which all the gear for manipulating machinery, guns, steering, &c., is placed. A complete installation of electric light is also fitted. The crew numbers 252 all told, for whose comfort ample accommodation has been provided.

After the launch the toast of "Success to the *Melampus*" was proposed by Mr. A. D. Bryce-Douglas, managing director of the Naval Construction and Armaments Co., coupled with the name of Mr. W. H. White, the designer of the vessel.

Mr. White, in replying, said it gave him great pleasure to be present that day to witness the launch of a vessel for which he was personally largely responsible, into the element in which he hoped she would prove of some useful service to the country. He was quite sure that in placing the order to build three cruisers in the hands of Mr. Bryce-Douglas and his able staff in this great yard, all that could possibly be done in the realization of the intentions of the designers of the ships would be done. They were indebted to Mr. Bryce-Douglas for considerable improvements in the engineering of these ships. It was perfectly well known that while the design of a ship was originated by the Admiralty, and worked out by them in every detail so far as the machinery was concerned, great freedom was given to the contractor, and in the *Latona*, *Melampus*, and other sister ships they would have ample evidence of the great skill and experience which Mr. Bryce-Douglas possessed, and the Navy would be all the better for it. It was only right that he should say one thing more. The Admiralty at the present time in its naval programme was building 70 ships, and 32 of these were being built in private yards throughout the country. It was a matter of the greatest satisfaction to the Admiralty when three of these 32 ships came to Barrow, and he quite recognized the fact that Barrow had put two of these vessels into the water before any of the other builders had been able to launch their first. Without wishing to detract from other builders, he thought this was a feather in the cap of Barrow. He proposed the toast of "The Naval Construction and Armaments Co.," coupled with the name of his old friend and colleague, Admiral Boys, a director of the Barrow Co.

Admiral Boys, in replying, adverted to the fact that the ship they had launched that day was named after the frigate *Melampus*, which in 1798 captured a French frigate and 500 men on the Irish coast, her largest guns being 18-pounders.

Lord E. Cavendish proposed "The health of Mr. Bryce-Douglas," and paid a high compliment to that gentleman for the great improvement he had brought about in the Barrow yard since undertaking its management.

Mr. Bryce-Douglas replied; and after other toasts the proceedings terminated.

INDUCED DRAUGHT.

IN our May number of this year we gave the results of the first series of experiments conducted at the Admiralty Dockyards, at Portsmouth, of the system of induced draught, as applied to marine boilers, introduced and patented by Mr. W. A. Martin.

The second and final series has just been concluded, and we propose briefly to give the results. As we stated in our last article, the boiler selected was one of the locomotive set removed from the *Polyphemus*, but at the end of the first series of experiments the tubes were found to be so leaky that retubing was determined on, and this having been accomplished, the experiments now under consideration were begun.

We may state that the reason which induced the Admiralty authorities to undertake these experiments was the repeated breakdowns of their vessels, when under trial, from leaking tube plates when new, and even when these vessels were passed into service, the uncertainty, and indeed danger, which attended the working of the engines when at full speed have formed the subject of very frequent inquiries, but without any satisfactory conclusions following. We have only to recall the disastrous trial of the *Barracouta* and the failure of the *Barham*, and the fact that none of the *Seagull* class of vessels have realized their contract H.P., to show us that there must exist some serious defect in the present systems of forced draught. That the Admiralty authorities were alive to this is clearly proved by the orders given to the vessels of the various squadrons which were engaged in the recent manœuvres, to use light power. Further, although all the recently built vessels are fitted with closed stokeholds, yet they are prohibited from using forced draught except on very urgent occasions, and we understand that none of them in an endurance trial can ever run more than four hours at their maximum power. As we before explained Mr. Martin's system for rapidly raising steam without any danger to the boiler is exactly a reversal of that of *forced* draught. His plan is to *draw* the hot air through the tubes by means of a fan placed at the root of the funnel in place of *forcing* it through the tubes by fans in the stokehold, and he claims that with his method stoking will be less laborious and difficult and that the impinging of the blast upon the tube plate will be very much lessened if it is not altogether prevented.

The total effective grate surface on the present trials was 20·77 square feet, and the total effective heating surface was about 758 square feet. The coal used during the steaming was "Harris's Deep Navigation," and the test lasted for four days for eight hours each consecutively, and the final trial, as a crucial test, was from the 5th to the 9th of August for 96 hours with intervals for cleaning fires, the longest uninterrupted run being for 11½ hours.

We give a tabulated statement of the results obtained.

		8 Hours.	96 Hours.
Steam pressure	lb.	74·3	75
Air pressures:—			
Smoke box	lb.	2·06	—
Eye of fan	lb.	2·5	—
Base of funnel	lb.	·54	—
Temperature of feed		62	61
Temperature of atmosphere		67·3	—
Revolutions of engine		139·8	104
Revolutions of fan..		636·9	430
Cubic feet of air per square foot of grate per minute		352·4	—
Lbs. of water evaporated per lb. of coal at actual temperature		8·3	9·77
Lbs. of water evaporated in same ratio at 212 deg.		9·58	11·29
Lbs. of coal consumed per square foot of grate per hour		63·7	39·87
Lbs. of water evaporated per square foot of grate at actual temperature ..		528	389·6
Ditto at 212 deg.		610	450·37

These clearly show that, with induced draught, a marine boiler is capable of steaming at a much higher rate with induced draught than with forced injected air, and this too with perfect safety; and that the *maximum* power can be maintained for any length of time in the longest voyages, whereas at present that power is confined to, at the outside, four hours.

Another very great advantage of the new system lies, as we pointed out in our previous article, in having a perfectly free and open stokehold, and to anyone who has realized the insufferable heat and choking effect of a *closed* one, this alone would recommend Mr. Martin's system for general adoption. We may add that the fan is under easy control, and the engineer in charge can command any desired rate of speed by merely turning a lever in connection with it.

Altogether, Mr. Martin may be congratulated on the results of these trials, and although they were conducted under his own superintendence, they were carried out by the Dockyard authorities themselves, and we believe that the results obtained may necessitate the discontinuance of the present method of working under forced draught.

MESSRS. FLEMING & FERGUSON, shipbuilders and engineers, Paisley, have received an order for the construction of two steam barges for the Japanese Government to be used in connection with the harbour works at Yokohama. They will be fitted [illegible] builders with their patent quadruple engines to ind[illegible], and will have heavy steam cranes on deck for h[illegible] blocks.

IMPROVEMENT IN BOILER-MAKING.

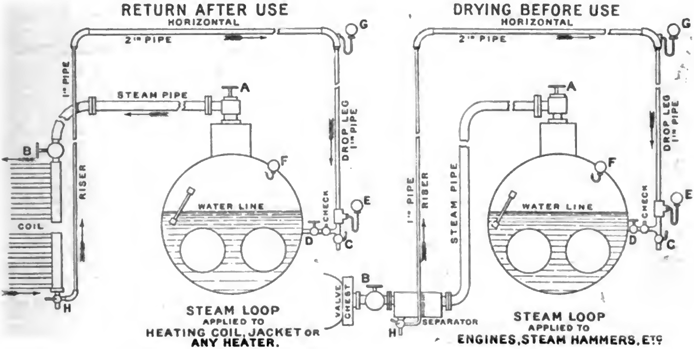
IN this essentially commercial and utilitarian age, when the exercise of the inventive faculties is stimulated by necessity and rivalry alike, new methods and principles of construction in engineering and boiler-making are at all times of paramount interest and importance. The firm of C. D. Holmes & Co. is indissolubly associated with the history and development of engineering and boiler-making in Hull, and the chronicles of this house mark step by step the improvements which have been effected from time to time in a trade which has contributed so largely to the welfare and prosperity of the town. With the ripened results of inherited and acquired experience constantly before them it is not surprising that Messrs. Holmes should be anxious to improve and perfect old methods, and to invent new ones. They have succeeded, for instance, in introducing an entirely new principle in the construction of land boilers. They are now engaged in making a boiler for Mr. Rank's new steam roller mill. It is 30 ft. long, 7 ft. 6 in. mean diameter, and will work at 150 lbs. pressure. The novelty and improvement in the construction of this boiler consists in the two internal flues with which it is fitted. The flues are corrugated, and the advantages of Messrs. Holmes' patent corrugations as compared with other tubes, are perfectly obvious—in that they can be placed at any distance to suit the pressure required. They are made of Siemens-Martin steel, and they are welded perfectly solid, both longitudinally and circumferentially, thus doing away with any possible chance of leakage, as is the case with other tubes, from the rivets in the seams. These tubes possess the added advantage of being easy to clean. There are no rivet heads and hence the accumulation of dirt is avoided. What this means those who have to do with boilers will at once understand without any explanation. The tubes are made from straight plates rolled and welded longitudinally, and afterwards corrugated by Messrs. Holmes' process. They are then fitted together and welded circumferentially. The latter process is entirely novel, and requires very skilful manipulation. The flues, on being welded together, are raised about 3 ft. from the floor, and fixed on rollers. The fire is run underneath them, thus heating them from the outside. After being made welding hot they are turned up on fixed rollers. There is an anvil fixed inside which keeps perpendicular the whole of the time the box is rolling over. The machinery by which the corrugations are placed is of very simple construction, namely, an ordinary rivetting machine, such as is to be found in most boiler works, but through the ingenuity of the proprietors of the establishment it has been adapted to this special class of work. It should be stated that the boiler furnaces, with the patent corrugations, have been fitted on board a large number of steamers, and have given general satisfaction. They can be adapted to either marine or land purposes. While the corrugated flue is not a new feature in boiler-making, the welding of the flue circumferentially, making one solid mass 30 ft. long, is quite a new departure in land boiler-making. The welding, as may be readily supposed, gives increased strength and durability to the work. We understand that Messrs. Holmes have had four commissions for the Hull Red Cross Fleet in respect of their patent corrugated flues. In these instances the tube plate has been flanged and welded on to the flue under the superintendence of Messrs. Jamieson & Taylor, who are the consulting engineers to the Red Cross Fleet. Those fitted on board the *India* and *Malta* now at sea are giving the greatest possible satisfaction. Messrs. Holmes, we may mention, made the boiler for Mr. Rank's other mill, and it gave so much satisfaction as to induce the firm to undertake the execution of his present order.

WE have received a catalogue of machinery, tools, and engineers' sundries from Messrs. Jones, Burton & Co., of Castle Street, Liverpool, which is intended to enable buyers abroad to communicate their wants home. In most cases prices are given with code words and other details of different sizes. In the section, prime movers, high-speed engines are found as well as ordinary types, all fully illustrated. There are also water, hot-air, petroleum and other motors. Lifting machinery of most kinds receives proper attention, as also the various forms of machine tools. Hand tools and sundries include the usual goods wanted by engineers, boilermakers, foundries and smiths' shops. An index completes the work, which is very serviceable for the purpose for which it is intended. Other sections are announced to follow as early as possible, those we notice filling nearly 300 pages.

BURNHAM'S STEAM LOOP.

SOME months ago Mr. Burnham, a well-known American engineer, introduced into this country an invention of his own, which had previously been extensively used with much success in America, for supplying perfectly dry steam to engines, marine or otherwise, and at the same time returning to the boiler, hot and pure, the water resulting from condensation or from that great bugbear in some boilers —priming.

This invention Mr. Burnham styles "THE STEAM LOOP," and the results of its adoption are simply astonishing. Like most other ingenious improvements in connection with the steam-engine this one is simplicity itself. Its great advantage lies in the prevention of the water, which is more or less carried over by the steam, from reaching the cylinders, and at the same time returning this water to the boiler at a very high temperature.



STEAM LOOP APPLIED TO HEATING COIL, JACKET OR ANY HEATER.

STEAM LOOP APPLIED TO ENGINES, STEAM HAMMERS, ETC

The Steam Loop consists of a separating chamber placed on the steam pipe near the engine, in which the condensed water is accumulated, the perfectly dry steam alone passing on to the cylinders. From this separator the water is driven up a vertical pipe, called the "riser," by the force of the steam until it reaches an elevation considerably above the boiler water-line; it then flows along a horizontal portion called the "horizontal," and another vertical tube, called the "drop-leg," descends, and through a valve at its lower end enters the boiler at a point well under the water-line. It matters not whether the condensing chamber is situated above or below the boiler level, the flow of water into it is all the same—continuous. In the great majority of cases where steam is used the condensed water is below the boiler, and traps, tanks, and pumps are used to raise it, because these are deemed to be necessary, but this discovery of Mr. Burnham's shows that nothing more than a *pipe* is required, if that pipe be run in the proper way.

We illustrate the Loop's application to a radiating coil and to a steam-engine, and in describing it let it be understood that its "riser" and "drop-leg" must be a pipe of 1 in. diameter—the "horizontal" may be 2 in. or any other size. When the steam leaves the dome of the boiler at A, it passes through the steam pipe into the separator, where the water carried over with it is caught, as well as that which condenses in the pipe itself. From the bottom of the separator the 1 in. pipe rises to an altitude above the water level in the boiler, it then takes a horizontal direction, and finally descends and enters the boiler at D. The water which has accumulated in the separator follows the course of the pipe and flows into the boiler at a higher level than that of the separator. The philosophy of the Loop's action is readily understood. Let us assume that it is working, and that full boiler pressure is freely admitted throughout the steam pipe and Loop. Now if the pressure were exactly uniform throughout the whole system, the water in the drop-leg would stand on the same level as the water in the boiler. But as a matter of fact the pressure is *not* uniform throughout the system, but steadily decreases from the moment of leaving the dome. This reduction of pressure is due partly to condensation and partly to friction, and, although generally small, is always present in some degree, and the lowest pressure in the whole system will be found in the drop-leg of the Loop, the point furthest from the boiler reckoned by the flow of steam. Let it be further assumed that the drop-leg is closed by an imaginary stop-valve at the water level of the boiler. In our illustration we will assume that the total loss of pressure is 5 lbs, *i.e.*, the downward pressure on the top of the supposed valve is 5 lbs. less than the upward pressure from the boiler underneath the valve. If this valve be now opened equilibrium will be established by the boiler forcing a column of water up the drop-leg to such a height that the weight of the column of water added to the steam pressure in the drop-leg will balance the steam pressure in the boiler. This imaginary stop-valve, if closed, would form a "dead end" in the drop-leg. Now it is well known that water produced by condensation invariably works towards, and accumulates in, a "dead end." This is due to the fact that, as already shown, the pressure is lower at the "dead end" than at any other point in the system; and as a consequence there is a constant flow of steam towards the point of least pressure, which flow continues as long as condensation goes on. This flow, or rather sweep of steam, carries along with it all the water formed by condensation or contained in the steam, at first in the form of a thin film swept along the inner surface of the Loop, and afterwards, when the water has sufficiently accumulated, in the form of small slugs or pistons of water, which completely fill the pipe at intervals, travelling rapidly towards the "dead end." The working model which we inspected at the offices of Mr. Charles Blagburn, C.E., M.I.N.A., &c., at 150, Leadenhall Street, in which all the tubes are made of glass, gives one almost at a glance all that we have attempted to describe. The action of the steam sweep is vastly more powerful than is usually supposed, and, of course, operates continuously and infallibly to deposit water at the "dead end" as fast as it is accumulated. A moment's thought will show that if the imaginary valve were removed we should still have a "dead end" as before, formed by the presence of the obstructing column of water, and we have just shown that this column would rise by accumulation until it reached a height which would balance the difference of pressure. As the Loop will still continue to bring over water, it follows that as fast as a slug or piston of water is deposited by the steam sweep on the top of the column it overbalances the equilibrium and an equal amount of water is discharged from the bottom of the column, through the check valve, into the boiler. The water is thus returned to the boiler without loss of pressure and without much appreciable loss of heat.

For working the Steam Loop the instructions are simple. Open the valves, A, on boiler, and B, also the blow-off valve C, keeping the valve D closed. As soon as all air and water are discharged and live steam blows out, close C, then steam-gauge E will show the pressure in drop-leg. Allow the drop-leg to fill up with water, and as soon as steam-gauge E shows a little excess of pressure over steam-gauge F on boiler, open D and the water will run out of the drop-leg into boiler until the gauges E and F show the same pressure. The difference between the gauges G and F will show the loss of pressure, which must be made up by the rising of the water in the drop-leg. This difference, multiplied by 2·4 ft. gives height of column of water in drop-leg above water-level in boiler. New water coming over cannot stay in the drop-leg, but flows continuously and automatically into the boiler.

The advantages of the Steam Loop may be briefly summed up as returning to the boiler all water of priming and condensation hot and pure; it dispenses entirely with traps, tanks, and pumps; it creates a return steam circuit, and increases temperature and pressure; it keeps steam pipes hot and dry when fires are banked; it saves fuel, and reduces scale, and keeps all steam-pipe joints tight.

This very simple, but beautiful invention is in fact an adaptation of natural forces, and is being largely used on triple-expansion marine engines, to which it can readily be adapted, and we believe the reports of the engineers to some of the largest steamship companies express the opinion that the Steam Loop is one of the most useful inventions of the age, and should form part of the equipment of every engine-room.

The sole licensee of this patent so far as the United Kingdom is concerned is, we understand, Mr. John Gillespie, of Leadenhall Buildings, Leadenhall Street, London, E.C.

THE PROPOSED NAVAL EXHIBITION.

On August 18th the first meeting of the council of the proposed Naval Exhibition was held in the Board Room of the Admiralty, Whitehall, the First Lord of the Admiralty being in the chair. The attendance was a large one, among those present being Admiral Sir William Dowell, K.C.B., Admiral Sir G. H. Richards, K.C.B., Admiral Sir James Brandreth, K.C.B., Sir E. Birkbeck, M.P., Admiral Sir William Graham, K C.B., Admiral Henry Fairfax, C.B, Captain W. Collins (superintendent Greenwich Hospital School), Colonel J. H. Poore, R.M.A., Colonel John F. Crease, C.B., R.M.A., Professor J. K. Laughton, Captain F. Durrant, C.M.G., Professor W. Anderson, Sir Nathaniel Barnaby, K.C.B., Mr. A. B. Forwood, M.P., Mr. E. Ashmead-Bartlett, M.P., Sir George Hayter Chubb, Admiral Mayne, C.B., M.P., Admiral Sir E. Inglefield, K.C.B., Admiral P. H. Colomb, Mr. W. H. White (Director of Naval Construction), Major-General Howard Jones, C.B., and Mr. W. H. Christie (Astronomer Royal).

Lord George Hamilton announced that the proposal to hold the exhibition had been most warmly received, and that Her Majesty the Queen had not only graciously consented to be the patron, but had stated that she would be pleased to allow any objects of interest in her possession connected with the Navy to be exhibited.

Mr. Forwood, on behalf of the Provisional Committee, nominated the sectional committees which were to have charge of the different departments of the exhibition. He also stated that His Royal Highness the Prince of Wales had consented to be president, and his Royal Highness the Duke of Edinburgh to act as one of the vice-presidents.

Admiral Sir William Houston Stewart was unanimously invited to act as chairman, and Admiral Sir William M. Dowell as vice-chairman of the executive committee. Captain Jephson was appointed honorary secretary, and Mr. Forwood honorary treasurer.

Among the sub-committees appointed was one to be intrusted with the duty of obtaining from private collectors the loan of pictures, historical relics and manuscripts. A strong sub-committee was also appointed, whose duty it will be to collect and arrange models showing the progress of naval marine architecture and engineering. It was reported that guarantees to the extent of nearly £25,000 had already been promised.

One of James Nasmyth's First Steam Hammers.—The publication of James Nasmyth's will within the past few days has had the effect of bringing forth an interesting statement in Greenock, which is, that one of his first hammers, if not, indeed, his very first, was supplied to a blacksmith in that town, by name Robert Boag. If that be the case, there is afforded some explanation of the fact that the great engineer-inventor in his will provided for "The Greenock Workshop for the Blind" receiving a very handsome bequest.

EXPRESS TRAINS IN CONNECTION WITH OCEAN PASSENGER STEAMSHIPS.

London and South-Western Railway Company.

NOT only do the vast majority of first and second-class voyagers in the faster oceanic liners appreciate rapid passages, but also the best and fastest express trains to and from their ports of embarkation and landing, and so timed as to be most convenient to such passengers as a class.

Now, notwithstanding the great progress which has been made in the speed of oceanic steamers during the last ten years or so, it is only recently that our railway companies have appreciably recognised their obligation of running accelerated express trains in connection with leading passenger steamers on the principal ocean routes. So well, however, at the present time do some of these companies fulfil this duty, that they despatch special trains direct to and from London to the steamers on several leading lines on their day of sailing, so that their trains arrive a very short time before the ships leave their ports of embarkation. Special trains are also run by these companies to London for the conveyance of passengers who land at such ports if there are a sufficient number to enable the companies to run the "specials" with a moderate profit.

We will now give a brief account of the improved train service referred to. One of the leading ports of call in the United Kingdom to embark and land passengers is Southampton, which is about 78 miles from Waterloo Station, in London, the terminus of the London and South-Western Railway Company.

The steamers which stop at and put-off at this port for taking and disembarking passengers are (*a*) the liners of the Royal Mail Steam Packet Co. to and from the West Indies and Colon, and others to and from Lisbon, Brazils, and the River Plate; (*b*) the ships of the Union Steamship Co. to and from Lisbon, Madeira, the Canary Islands, the Cape, and other parts of South Africa; (*c*) Lamport and Holts' liners to and from the River Plate direct; (*d*) North German Lloyd's steamers to and from New York, and others to and from Ceylon and Australia, and from Japanese ports, and China; (*e*) The liners of the Hamburg-American Steam Packet Co. to and from New York; (*f*) the ships of the Nederland Steamship Co. to and from Java; (*g*) the steamers of the Rotterdam-Lloyd's Co. to and from Java.

Special trains are run for the Royal Mail, Union, North German Lloyd's, and the Hamburgh-American steamships, at certain times agreed upon between the London and South-Western Railway Co. and the owners of these steamers. Those for September are run as follows from Waterloo Station, viz.—One on the 3rd and 17th, for passengers by the Royal Mail Co.'s steamship to the West Indies; and on the 12th and 26th, for passengers by the same company's liners to the Brazils. On the 5th and 19th a special fast train is despatched for passengers by the Union Steamship Co.'s line to the Cape and other parts of South Africa. All these specials start at 9.45 a.m., and land their passengers at Southampton Docks within two hours, and often in 1 hour and 40 minutes. Every Thursday a special fast train leaves Waterloo Station at 12.30 p.m. for these docks, for passengers by the North German Lloyd's line of steamers. Very recently a special train of about equal speed has been run between these termini for passengers by the ships of the Hamburgh-American line, and which starts at 9 a.m.

All these special trains which run direct to the docks are particularly appreciated by passengers. They consist of very good and convenient first and second class carriages, with compartments for baggage.

Every Sunday also a special train will leave Waterloo at 12.25 p.m. for Southampton Docks, for passengers by the North German Lloyd's American line of steamships. Special trains will be arranged to run from Southampton to Waterloo if 40 first-class passengers or more require to travel to London.

On week-days there are several fast trains running between Waterloo Station and Southampton, and *vice versâ*, in a little over two hours. By some trains, however, to and from Southampton West Station the journey can be made between London and Southampton in less than two hours.

The new direct double line from Exeter *viâ* Lidford and Tavistock to Devonport and Plymouth has recently been opened. In consequence of this a greatly improved and accelerated service of trains are now run by the South-Western Railway Co. between Waterloo and Plymouth, whereby the time in arriving at the latter place has been greatly reduced, and has caused the Great Western Railway Co. to run a train there much quicker than it formerly did. This important reform has been, and will be, a great boon to ocean voyagers, many of whom embark and disembark at Plymouth.

The steamships which stop at Plymouth for this purpose are some of the best of our ocean liners. Those which embark passengers are the steamers of the Orient Line for Australia, *viâ* Naples; the Shaw, Savill & Albion Co.'s liners, for New Zealand; and the steamers of the New Zealand Shipping Co., for Teneriffe, Hobart and New Zealand.

There are far more ocean steamships which land passengers at Plymouth than take them on board at this port. Among the former there are, in addition to the ships before mentioned of the Orient, Shaw, Savill & Albion, and New Zealand Shipping Co., which stop at Plymouth on their homeward voyages, the steamers of the following companies, namely—(*a*) The P. & O. from China, Bombay and Brindisi, and the same company's steamers from Calcutta, Marseilles, and others from Australia and Brindisi; (*b*) the Royal Mail Co. from the West Indies and Brazil; (*c*) the Castle Mail Packets Co. from Cape Town and Madeira; (*d*) the Pacific Steam Navigation Co. from the West Coast of South America; (*e*) the British India Steam Navigation Co. from Calcutta, and Bombay, Brisbane; and (*f*) the Clan Line Co. from Calcutta.

No special trains are run to Plymouth from London as to Southampton. Several of such trains, however, at a high rate of speed, are despatched from Plymouth to London with voyagers who have landed there.

For economising the time of outward voyagers from Plymouth there are several fast express trains which are worth noticing, as they properly come under the denomination of express trains in connection with ocean steamships.

The first important train for the benefit of those embarking for Plymouth, run by the London and South-Western Railway Co., is the one which starts from Waterloo at 11 a.m. and reaches its destination at 4.48, after stopping at Salisbury, Templecombe, Exeter, Okehampton, Tavistock and Devonport only. By the next fast train, called the "West of England Express," which starts at 2.40, passengers are conveyed from London to Plymouth in 5 hours and 20 minutes, the run from Exeter to that port being made without stopping. This is an excellent performance, and excels the speed of the former train between the Metropolis and Plymouth by 24 minutes. The early morning train which starts from Waterloo at 5.50, and arrives at Plymouth at 11.19, is a very fast one, and is likely to increase in appreciation, although it is inconveniently early for most voyagers. Although the service of fast trains between Plymouth and Waterloo have been greatly accelerated, some run at the speed of the slower of the two last-mentioned expresses to Plymouth.

Midland Railway Company.

There is also a good service of trains between the North of England and the midland counties to and from Plymouth on the Midland Railway *viâ* Bath, and from thence by the Somerset and Dorset and London and South-Western lines. Through carriages are run from Sheffield and Birmingham to Plymouth by the train which arrives at the last-named place at 3.42 p.m., and also by the train leaving there at 10.57 a.m.

From the North and the Midlands, *via* Bristol, to Plymouth there is an excellent service of trains, the faster ones of which have recently been accelerated. The runs between Derby and Bristol are much to be commended, both on account of the very high speed maintained and the few stoppages made between them. The train which starts from Derby at 10.30 a.m. and arrives at Bristol at 2.5 is an excellent one. It only stops before it reaches Bristol at Birmingham, Cheltenham, Gloucester, and Mangotsfield. To prevent its speed being reduced between Birmingham and Cheltenham it does not run through Droitwich or Worcester, which are situate on the Great Western Railway, but on a loop line of its own from Stoke Prior, north of Droitwich, to Abbots' Wood Junction, west of Worcester. Passengers by such train proceed by the "express" in connection with the "Flying Dutchman," which reaches Bristol a few minutes afterwards, and they arrive at Plymouth at 5.55 p.m. Through carriages are run from Edinburgh, Glasgow, Liverpool and Manchester to Bristol, and *vice versâ*.

Another splendid express by the Midland Company to Plymouth, with Liverpool and Manchester connections, is the one which starts from Bradford at 11.15 a.m., Leeds at 11.45, Sheffield at

12.59 p.m., Derby at 2.5, Birmingham at 3.12, Bristol at 5.25, and arrives at Plymouth at 8.55. This train is also run over the loop line referred to. The greater part of the passengers for Australia and New Zealand and other long-distance ports, who embark at Plymouth, arrive there the day before their steamers sail.

There is also through-booking in operation between the principal stations on the Midland Railway and Plymouth *viâ* Bristol. Third-class tickets are available for travelling over the Midland Railway by any train, and also by any train over the Great Western Railway, except that leaving Bristol for the west in connection with the "Flying Dutchman," or the 11.45 express from Paddington. For the convenience of passengers travelling by these express trains, special through tickets are issued between leading stations, which are available for travelling third-class over the Midland Railway and second-class over the Great Western Railway.

For the advantage and convenience of passengers from America for London *via* Queenstown and Liverpool, the Midland Railway Co. have acted in a very praiseworthy manner which cannot fail to cause their line to London from Liverpool by these passengers to be much used by them.

In the first place, if the passengers on board the steamers from New York do not reach Liverpool at a convenient time for going forward to London by one of the company's regular express trains it will run a special express train from the Central Station at Liverpool to London, when there are a reasonable number of passengers.

Between Liverpool and London drawing-room saloon cars are attached to the day express trains. Passengers having first-class tickets are allowed to travel in these carriages without extra payment. By the 4.35 p.m. train between Liverpool and London and the 5 p.m. train from London to Liverpool, accommodation is provided for passengers to dine *en route*. No additional charge beyond that which for the dinner is made.

Sleeping saloon carriages are also attached to the night trains between Liverpool and London, the charge for each berth being 5s. beyond the first-class railway fair. A separate apartment is reserved in the sleeping saloons for ladies travelling alone. Saloon carriages are provided on application without extra payment by any of the trains for seven or more first-class passengers. There is a great demand for these cars by Americans especially. They are very comfortable vehicles and are fitted with lavatory accommodation.

The representative of the Midland Railway Co. at Queenstown visits all the Atlantic steamers calling at that port on their way from New York to Liverpool. He is prepared to furnish full and satisfactory information respecting the arrangements of the Midland Railway for the conveyance of passengers or to telegraph to Liverpool, for sleeping saloons, reserved compartments, or any accommodation which may be required by passengers travelling from Liverpool to London by the Midland route. Passengers desiring this special accommodation should, before their steamer arrives at Queenstown, deliver to the purser a letter stating their requirements, addressed to Mr. James Ryan, Midland Railway Agent, Queenstown, and then these will receive prompt attention.

On the 6th of August a special express train, conveying American passengers, was run from London to Liverpool in connection with the *City of New York*, which sailed on the afternoon of that date. The train left St. Pancras Station at 8.30 a.m., and arrived at Liverpool at 1.15 p.m., after stopping at Leicester and Stockport only, being fifteen minutes earlier than its stipulated time. The train was made up with one Pulman car, two first-class carriages, one bogie third-class carriage, and two vans. This performance, which we understand is to be repeated, is a highly creditable one to the company, and is another significant indication of its renowned enterprise.

To further facilitate travelling in the United Kingdom and other parts of Europe to voyagers from the United States, the Midland Railway Co. have passenger agents in the great Republic. Through tickets, therefore, both for the ocean passage by all lines of steamers, and the railway journey from Liverpool or Glasgow to London, Paris, Switzerland, Italy, and all parts of the continent of Europe, Egypt, and Palestine, with time tables and all necessary information concerning the passenger service of the Midland Railway Co. may be obtained at the offices of its agents, Messrs. Thomas Cook & Son, 261 & 262, Broadway, New York; 332, Washington Street, Boston; 232, South Clark Street, Chicago; and 79, West Bay Street, Jacksonville.

Baggage is checked from Liverpool to London on the Midland Railway. For the convenience of passengers going to America, the Midland Railway Co. also check the baggage of passengers (who have taken tickets from London to Liverpool by their route) through from London to Liverpool, and deliver it to the tender or to the steamer if it leaves direct from the dock. The charge for checking is 1s. per package beyond any excess charge which may be incurred, and includes cartage and porterage at Liverpool. If passengers, therefore, have their baggage checked they will be relieved of the trouble of taking it themselves across Liverpool (which generally occasions much trouble and annoyance), and will find it on board the steamer. Baggage not checked must be claimed by the owner on the arrival of the train by which the passenger travels at Liverpool Central Station.

Passengers travelling by the Midland Railway to London, Birmingham, Leicester, and Nottingham, can for a charge of 6d. per package have their luggage registered at the Central Station, Liverpool, and it will then be delivered to the address stated on it. If, however, the destination is beyond the free delivery boundary an extra charge of 3d. will be made for each package. On Sundays there is no delivery of baggage.

Travellers or tourists will be waited upon at their hotels or residences in London, if required, by a representative of the Midland Railway Co. to secure orders for checking their baggage through to Liverpool, delivering it to the tender or the steamer, and to make arrangements for providing conveyance to St. Pancras Station, and accommodation in the train, &c. He will also be glad to make appointments at hotels or private residences to arrange for saloon carriages, or other accommodation required by passengers desirous of travelling by the Midland Railway.

To avoid the carriage of much heavy luggage when passengers are making their journey, the company have arranged to adopt a system for conveying such luggage in advance of the passengers. The charge for this service, including collection from hotels and residences within the usual limits and delivery to the tender at the landing stage, is one-half the excess luggage rate, viz., ½d. per lb., with a minimum charge of 1s. The baggage should be received at St. Pancras Station not later than 24 hours, or at any of the company's offices not later than 27 hours, before the advertised time of the sailing of the steamer. Twenty-seven hours' notice should also be given to the stationmaster at St. Pancras Station by passengers requiring baggage to be collected from their residences.

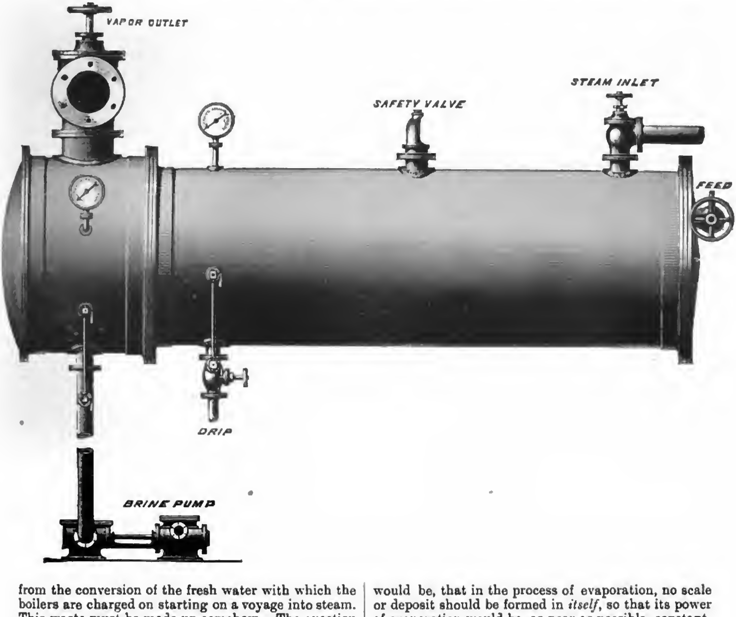
Arrangements can also be made for baggage to be carted from any hotel or private residence in London within the usual limits to St. Pancras Station at a charge of 6d. per package in addition to the checked baggage. Passengers will thus be relieved of all trouble at the station or in passing through Liverpool. Orders for its collection and conveyance should be given at the time of obtaining passenger tickets for Liverpool. Communications by post or telegram to the stationmaster at St. Pancras, or Mr. A. H. Boylan, 13, Aldersgate Street, will receive prompt attention.

From what has been stated it will be perceived that the facilities afforded by the Midland Railway Co. to voyagers to and from North America are very great, and go far to dispel the prejudice which many Americans have manifested against English railway travelling accommodation, on account of its alleged deficiency as compared with that on the leading lines of the United States.

New Line of Steamers from Bristol to Australia.—The Bristol Docks Committee announce that they have completed negotiations with the Anglo-Australian Steam Navigation Co., Limited, for a regular line of steamers to be started forthwith between the Avonmouth Docks, at the river's mouth, and Adelaide, Melbourne and Sydney. Messrs. William Milburn & Co., the London agents of the company, have arranged for these large steamers to leave Bristol, and considerable shipments both of deadweight and measurements goods have been promised by merchants, manufacturers, and traders in the western counties. A large trade was formerly carried on between the old port and Melbourne in sailing ships, and it is hoped that this new departure will not only be beneficial to the port and advantageous to traders and manufacturers, but enable the dock estate to show a balance on the right side next year instead of the deficit just announced.

THE "YARYAN" DISTILLING APPARATUS FOR STEAMSHIPS.

THE vexed question of supplying an ample supply of fresh pure water to the boilers of marine engines is one which is exercising the inventive genius of marine engineers all over the world, and has now become one of paramount importance since the adoption of high-pressure steam. Numbers of evaporators or distillers have been introduced with the view of supplying that waste which must inevitably take place from the conversion of the fresh water with which the boilers are charged on starting on a voyage into steam. This waste must be made up somehow. The question is, how is it to be done? The supply must be drawn from the sea, but before it is allowed to pass into the boilers in the shape of feed make up, it must be purged of its salt and other scale forming properties. As we have said, numbers of excellent evaporators have been introduced for this purpose, but somehow or other they seem to turn out not altogether satisfactory. Some of them do produce quite a sufficient supply of fresh water, but they seem pretty much all alike in showing the same defect, and that is, that while supplying a fresh make up to the boilers which prevents the formation of scale in *them*, the evaporators *themselves* become so clogged up with scale as to render them no longer able to supply the feed they were intended to do, and it seems as if the evil to be got rid of was only transferred from the boilers to the evaporators. That there is a defect existing somewhere, and somehow to be surmounted, is plain enough, and the old question recurs, how is it to be done? We should fancy that the first important feature of an evaporator would be, that in the process of evaporation, no scale or deposit should be formed in *itself*, so that its power of evaporation would be, as near as possible, constant, and frequent cleansing avoided, and besides its action should be continuous and automatic.



Americans have furnished us of late with some—to use their own phrase—"remarkable" inventions, and it seems that in the "Yaryan" evaporator—so-called after its inventor—they are once more to be "boss." The one distinguishing feature of the apparatus which we here illustrate, and which pretty well explains itself, is, that whereas in other accepted evaporators the sea water to be distilled is always at rest, in the "Yaryan" it is in a constant state of rapid motion. Further, owing to the feed being introduced in the form of spray, evaporation is much more quickly effected, the evaporative power of each pound of steam used being relatively far higher than in other machines, and above all, there is little or no deposit left on the tubes.

So far as we know at present the only steamer which has been fitted with this evaporator is the *Prudence*, of Cardiff, a new screw of something like 3,300 tons and 1,200 H.P., trading between America and France. Mr. Thomas Soper, late engineer inspector at the Admiralty, and now manager for Messrs. Humphries, Tennant & Co., of Deptford, visited, on the 7th August last, the *Prudence* at Rouen, and we gather from his report to the directors of the British Yaryan Co., Limited, of 7, Great St. Helen's, London, E.C. (who are the proprietors and manufacturers of this invention), that when he inspected the machine, it had been about 70 days under steam, during which time it had not once been cleaned in any way. He found that its interior was in a very satisfactory condition, the tubes only being coated with a thin scale or rather film, which at its thickest part did not exceed one thirty-second of an inch in thickness, a scale, which, of course was not sufficient to make any appreciable reduction in the efficiency of the machine. The water in the boilers, which were perfectly clean, had been taken in at New Orleans, and was found to be quite fresh. To keep it in this condition, the "Yaryan" had only been worked from four to five hours each day.

If such results as these can *always* be obtained, then the "Yaryan" has solved the problem, and henceforth, engineers, navy or marine, will find, like Christian in the "Pilgrim's Progress," that a load has fallen from their backs.

JOHNSON'S SELF-TIGHTENING TUBE STOPPER.

NOW that triple and quadruple expansion engines have become the order of the day, and consequently high pressure steam an absolute necessity, the possession of a perfectly reliable and quickly-acting tube-stopper is more than ever required. The stopper we here describe and illustrate, properly secures and stops leaky tubes in a much more simple, rapid and effective way than any other hitherto invented. Its greatest merit, however, consists in its instantaneous action when pushed home in the tube, requiring no attention or manipulation afterwards by the engineer or fireman. On both these grounds, viz., their self-action and thorough efficiency in closing up the tube, these stoppers should recommend themselves to the notice of marine engineers, who will, no doubt, hail them as a boon after using the ordinary stoppers with their attendant danger when screwing them up under the disadvantages of escaping steam, hot water and smoke. Johnson's stopper consists of a metal rod of a suitable length for the tube in which it is to act, and on each end of this rod are fitted two metal washers of a diameter to suit that of the interior of the tube. These washers are free to move longitudinally on the rod, and are formed with bevelled faces looking toward each other. Between these faces a ring of india-rubber, or other elastic material, of suitable section and same diameter as the tube, is inserted, also having bevelled side faces meeting the corresponding faces of the metal washers. Behind the washers are nuts screwed and fixed on the rod keeping the washers to their proper places for action on the elastic ring. The stoppers are supplied all ready for action. When a tube is found to leak the fireman (it does not require the presence of the engineer) has only to open the smoke-box door and push the stopper home in the tube, up to the shoulder of front washer, and the work is done. The two ends of the stopper become instantaneously closed by the escaping steam or water acting on the back of the two interior adjustable washers, which are by this means brought to bear on the elastic rings, and thus thoroughly seal up the tube, and the greater the leakage the more effective is the closing up. Nothing more is necessary to be done than the mere insertion of the stopper into the tube, as its action is automatic and instantaneous. Every engineer will see the great advantages which this stopper affords, by enabling him thus instantly to close up a leaky boiler tube without lowering steam pressure, and avoiding all danger when doing so. When the vessel has got into port, and the pressure of the boiler is lowered, the stopper having done its work at sea, its closing rings are automatically released, and it can then be easily withdrawn—to permit of a new tube replacing the

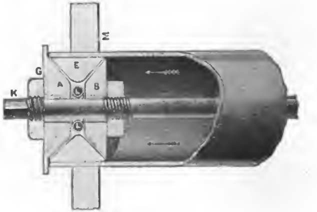


FIG. 1.

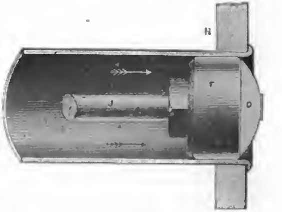


FIG. 2.

damaged one—and used over and over again. In addition to their great practical value, we understand they are manufactured at a cost of something like half that of the ordinary stopper now in use, and they are so durable that they will last as long as the boiler itself.

Figure 1 of our illustrations shows the front end of a boiler tube with a section of the stopper at that part, while figure 2 shows the back end of the same tube with stopper end in elevation. A B are the circular adjustable metal washers with bevelled faces. The washer A has a circular projection or shoulder so as to regulate the insertion of the stopper to its proper place in the tube. E is the ring of india-rubber, or other suitable elastic material, for closing up the tube ends. G are the nuts on the rod J, which adjust the movable washers ready for action. The solid head of rod J at the back end of the tube acts in place of a nut on its adjacent washer D. K is a square end on the rod for turning it by means of a spanner should that from any cause become necessary. L L is a circular elastic ring gripping on rod J between the washers, and prevents any escape of pressure there. M is the front, and N the back tube-plates of the boiler. The screwed portion of the rod J at the front end is long enough to permit of a protecting or shield plate being attached when found necessary. We understand that Mr. Johnson has received a large number of testimonials from eminent mechanical engineers, as well as from chief engineers who have had experience in the use of his stopper at sea, and they all pronounce it the best tube stopper they ever saw. They are used by some of the best shipping companies, and only require to become generally known to be used by all. The patentee and manufacturer's address is 3, Montagu Place, Poplar, London, E.

Scientific Boiler Fluids.—If pure water could be obtained for use in boilers, marine or land, there would be no occasion for the use of fluids to prevent scaling. Water, however, is such a solvent that in nature it is never found pure, even the virgin snow, the emblem of purity, contains, dissolved, impurities. Such being the case, in evaporating large quantities of it in the production of steam for machinery driving purposes, there must be a certain amount of residue left in the boiler producing the steam, and this residue takes the form of *scale*. The deleterious matter held in solution in water varies of course according to the source from which it is drawn, and any chemical mingled with one sort of water, which proved successful in preventing the formation of scale, might if used with a different water have quite another effect. Messrs. Sydney Minns & Co., of Trafalgar Road, Dalston, London, have taken this matter of scale-preventing fluids up, in a thoroughly scientific manner, in their boiler fluids. They treat it just as a doctor would a patient. The same medicine if applied indiscriminately to all suffering from illness would soon reduce the population of our world, and so would *one* boiler fluid shorten the lives of boilers if applied in the same way. Messrs. Minns say, when applied to for a scale-preventing fluid, "Send us a sample of the water you are using." This is analysed under the personal supervision of a highly qualified chemist, and the result of this analysis enables them to prepare a fluid exactly suited to prevent scale forming by the use of this particular water. Messrs. Minns & Co., we believe, have no *one* specific that will act on every kind of water, but they vary their compositions to suit the waters submitted to them for analysis, and we understand they do this free of professional charge. From the large and influential testimonials which Messrs. Minns & Co. have received, we are inclined to think that their system is a complete success.

A STEAM LIFEBOAT.

OUR double-page plate represents a new departure that the National Lifeboat Institution has lately gone in for. Many attempts have been made to embody recent developments of marine engineering in the designs of boats for rescuing those wrecked on our shores, but hitherto without much success. An important committee, comprising Sir Frederick Bramwell, Sir Digby Murray, and Mr. John I. Thornycroft, were asked to adjudicate upon models and drawings submitted to the Institution in an all-the-world competition as late as 1886. The direct results again were *nil*. Two years later, however, Messrs. R. & H. Green, of Blackwall, made proposals, the outcome of which was the boat we now notice.

The *Duke of Northumberland*, as she is called, is constructed of steel throughout. Her dimensions are 50 ft. long by 14 ft. 3¾ in. breadth over all, and 5 ft. 5⅛ in. depth; the mean draught is 3 ft. 4 in.; displacement, 24¼ tons; I.H.P., 170; and passenger accommodation, 30. It will be seen by the plans we furnish that the boat has several peculiarities as regards her mode of propulsion. The principle of a turbine for taking in water and discharging it again in the required direction has been tried before. On vessels for ordinary services it has hitherto been a failure. The efficiency was always too low for continuous running. With a lifeboat, however, the conditions are totally different. An effort has to be made for a short period of time only, and the cost within limits does not come into the question. The designers were presumably alive to this fact. Moreover, in adopting the hydraulic system to the purpose, they were not hampered by paddle-wheels, which would be in the way in going alongside a wreck; nor a screw, which on a short length like the above would be for ever racing, to the danger of the machinery. A further advantage they secure over both the paddle and the screw is that there is no obstacle to sailing that the wheels and, in a less degree, the propeller presents. With no projections whatever, nothing is in the way also of the boat taking the ground. It only remains, therefore, to give the further features of the little craft as they were worked out from the main idea. To ensure lightness and strength steel was a necessity. Very complete subdivision has been resorted to, there being five watertight compartments on each side and five athwartships, as well as two tanks underneath each, holding a ton of water, and capable of altering the trim. All of these can be rapidly drained by bilge pumps and steam ejector. The question of stability was a very important one, and it has, we believe, been proved in a practical test that the calculations as to self-righting power up to 120 degrees were quite correct. The well will seat all the passengers comfortably, the lockers containing the stores being used for seats. The water tanks mentioned are underneath this well, and are emptied if necessary as people are taken aboard. As the cockpit is likely to ship water, ten large freeing valves are provided of two different patterns, which will no doubt effectually prevent any flooding. There is an elm rubbing piece all round the boat to take any shocks that may occur when going alongside a vessel, and life-lines in the usual way to assist anyone clambering up the sides.

The one mast is fitted to lower between the two funnels when not used for sailing. When sail is set the funnels themselves are dropped out of the way. The rig is a lugsail and jib. The old traditions could not, we suppose, be altogether done away with, though there would appear to be no use for sails with steam power available for 30 hours on 2 cwt. per hour consumption. The steering gear is both by yoke lines and wheel, the latter being a patent screw gear. The rudder is Hickman's patent, and there is no difficulty in shipping and unshipping it; it rises and falls easily, and cannot get out of place. The capstan, so especially useful in work of this character, is driven by steam; it is fixed on the forward hood, and made of gun-metal, the engines for driving it being placed in a watertight compartment below, fitted with a watertight door.

Turning from the hull to the engine and boiler, the former is of the compound surface-condensing type of 10 and 14 in. cylinders, and 12 in. stroke. The line of motion is seen to be nearly horizontal, and in a fore and aft direction, the two rods being fixed to one crank. On the trial, which took place on the 24th July, the power indicated was nearly 200, and the average speed about 8½ knots. The stokehold is closed, and kept under forced draught by means of a fan engine running at high speed. The boiler is Thornycrofts' new tubulous pattern, with a heating surface of 600 square feet and a grate surface of 8½ ft. By this system water circulates through the mass of tubes and the fire plays outside. The design admits of easy cleaning, either in the ordinary way or by turning on a jet of steam. It is claimed, however, that little deposit takes place at all, and certainly there would be no objection under this head in the present case. Steam is said to be raised in a very short time, a little over twenty minutes. No doubt, however, in bad weather the fires would be kept banked always. The turbine delivers through the outlets at the rate of one ton per second. These are placed two on each side, the stream being always thus divided into two either ahead or astern. The supply is through the scooped inlet in the bottom. There is said to be an advantage in this shape over the flush form in about the ratio of 4 to 3. The opening is protected by two elm side keels which keep the boat upright when she takes ground. On the trial, going at full speed with rudder alone, a half-circle was made in 35 seconds, and a full one in 50 seconds. Slowly, with rudder and turbine to assist, the full circle was turned in 40 seconds, and with turbine alone in 52 seconds. With the levers on deck, which actuate the outlets, the boat was brought from full speed to dead stop in 32 seconds, and from dead stop to full speed in 4 seconds. These tests were stringently carried out, and prove how well the boat is under the control of the deck officer without any assistance from the engine-room. Should anything happen to the rudder, the turbine alone will do the steering, it is thus shown.

The station of the boat is to be at Harwich, and from the trouble of launching such a boat from the shore, it is to be supposed this class will be usually kept moored in sheltered situations. It is interesting note that mechanical appliances have thus proved nselves once more equal to any emergency. The arrangement and construction affords great credit on all concerned. It only remains to say that the boat is painted in the well-known colours of the Lifeboat Institution, and presents a neat appearance as she was seen by us in the East India Dock.

THE FRENCH NAVAL MANŒUVRES.

On Friday, August 1, writes a naval correspondent of the *Times*, the French evolutionary fleet, formed of a combination of their Mediterranean and Channel squadrons, strengthened by a few specially commissioned ships, broke up and returned to their respective stations. A comparison between this fleet and the English fleet engaged in the recent manœuvres may prove interesting to such of your readers as concern themselves in naval matters. The French fleet was composed of 34 vessels, and divided into 12 groups, each group being supposed to consist of an ironclad, a cruiser, and a torpedo boat. Three groups formed a division, two divisions a squadron, two squadrons a fleet. The following are the vessels composing the two fleets, arranged according to the similar types of ships in each navy. I have made use of the following abbreviations—viz., M.L., muzzle-loader; Q.F., quick-firing gun; M., machine-gun; T.T., torpedo tubes; C., 1st class unarmoured cruiser; C.2cl., 2nd class unarmoured cruiser; C.3cl., 3rd class unarmoured cruiser; K., knots. All guns not marked M.L. are modern breechloaders.

MODERN IRONCLADS.

FRENCH.

Names.	Tonnage.	Armour	Speed.	Armament.
		In.	K.	
Formidable ..	11,441	21·6	16·5	3 76-ton, 12 5·5in., 2 Q.F., 13 M., 4 T.T.
Admiral Baudin	11,380	21·6	15·0	3 76-ton, 12 5·5in., 16 M., 4 T.T.
Admiral Duperré	10,487	21·6	14·2	4 47-ton, 14 5·5in., 1 6·3in., 18 M., 4 T.T.
Admiral Courbet	9,652	14·9	15·5	4 47-ton, 4 27-ton, 6 5·5in., 20 M., 4 T.T.
Redonbtable ..	8,858	13·8	14·7	8 27-ton, 6 5·5in., 8 M., 4 T.T.
ENGLISH.				
Anson	10,600	18	16·7	4 67-ton, 6 6in., 19 Q.F., 7 M., 5 T.T.
Camperdown ..	10,600	18	16·7	
Rodney	10,300	18	16·7	
Howe	10,300	18	16·7	
Hero	6,200	12	15·5	2 45-ton, 4 6in., 12 Q.F., 6 M., 6 T.T.
Conqueror.. ..	6,200	12	15·5	2 45-ton, 4 6in., 6 Q.F., 12 M., 6 T.T.
Inflexible	11,880	24	13·8	4 80-ton M.L., 8 4in., 5 Q.F., 15 M., 4 T.T.
Ajax	8,660	18	13·2	4 38-ton M.L., 2 6in., 6 Q.F., 13 M., 2 T.T.
ANCIENT IRONCLADS.				
FRENCH.				
Marengo	7,187	7·8	13·5	4 27-ton, 4 16-ton, 12 M., 4 T.T.
Trident	8,456	8·6	14·2	8 27-ton, 2 16-ton, 6 5·5in., 2 Q.F., 14 M., 4 T.T.
ENGLISH				
Neptune	9,310	12	14·2	4 38-ton M.L., 2 12 ton M.L., 14 Q.F., 10 M., 2 T.T.
Belleisle	4,870	12	12·2	4 25-ton M.L., 6 Q.F., 9 M., 2 T.T.
Glatton	4,910	12	12·1	2 25-ton M.L., 3 Q.F., 4 M., 2 T.T.
Hotspur	4,010	11	12·8	2 28-ton M.L., 2 6in., 4 Q.F., 9 M., 2 T.T.
Iron Duke .. Invincible .. Audacious .. Triumph ..	6,010	8	13	10 12-ton M.L., 4 5-in. 4 Q.F., 15 M., 4 T.T.

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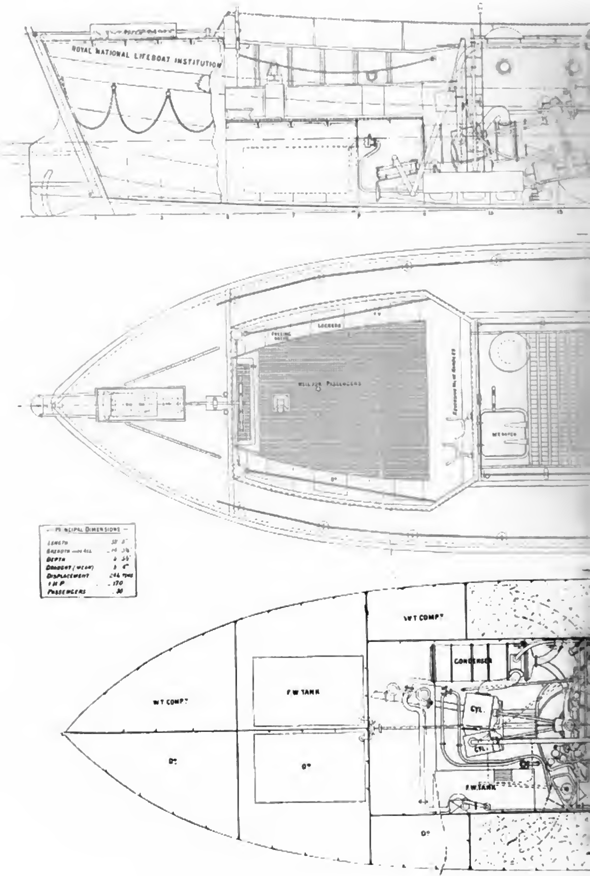
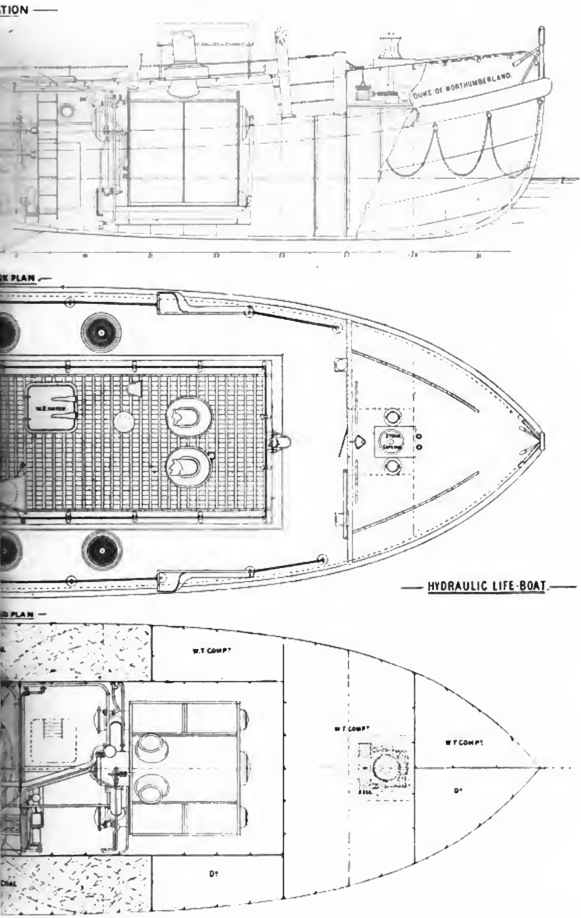


A STEAM LIFE BOAT FOR THE ROYA

BUILT BY MESSRS. R. &



— HYDRAULIC LIFE-BOAT. —

NATIONAL LIFE BOAT INSTITUTION.
GREEN, OF BLACKWALL.

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ASTOR, LENOX AND
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Name.	Tonnage.	Armour	Speed.	Armament.
Northnmberland	10,780	5·5	14·1	7 12-ton M.L., 20 9-ton M.L., 1 6in., 1 5in., 4 Q.F., 10 M., 4 T.T.
Minotaur	10,690	5·5	14·4	17 12-ton M.L., 12 Q.F., 6 M., 2 T.T
Black Prince ..	9,210	4·5	13·6	4 9-ton M.L., 22 6½-ton M.L., 2 6in., 4 Q.F., 7 M., 2 T.T.

HARBOUR DEFENCE IRONCLADS.

FRENCH.

Requin	7,168	19·7	14·2	2 76-ton, 4 Q.F., 4 M., 4 T.T.
Furieux	5,560	19·7	13·9	2 47-ton, 4 Q.F., 5 M.

ENGLISH.

Cyclops .. .. Gorgon .. .. Hecate .. .. Hydra	3,560	8	11·2	4 18-ton M.L., 4 Q.F., 5 M.

ARMOURED CRUISERS.

FRENCH.

Name.	Class.	Tonnage.	Armour.	Speed.	Armament.
			In.	K.	
Vanban .. Duguesclin Bayard ..	A.C.	5,880	9·8	14	4 16-ton, 1 7·5in., 6 5·5in., 2 Q.F., 2 M.

ENGLISH.

Narcissus Galatea .. Aurora .. Immortalité	A.C.	5,600	10	18·5	2 22-ton, 10 6in., 16 Q.F., 7 M., 4 T.T.
Shannon ..	A.C.	5,390	9	12·3	2 18-ton M.L., 7 12-ton M.L., 10 M., 2 T.T.
Northampton	A.C.	7,630	9	13·2	4 18-ton M.L., 8 12-ton M.L., 18 Q.F., 10 M., 2 T.T.

UNARMOURED CRUISERS.

FRENCH.

Sfax	C.	4,488	—	16·7	6 6·3in., 10 5·5in., 10 M., 4 T.T.
Primanguet ..	C. 2cl.	2,270	—	14·5	15 5·5in., 10 M.
Forfait	C. 2cl.	2,268	—	13·4	15 5·5in., 6 M.
Rigualt de Genouilly	C. 2cl.	1,643	—	14·5	8 5·5in., 2 M.
Forbin	C. 3cl.	1,848	—	20·2	2 5·5in., 8 Q.F., 4 M., 5 T.T.
Milan	C. 3cl.	1,546	—	18·4	9 Q.F., 6 M., 2 T.T.

ENGLISH.

Thames .. Mersey .. Forth	C.	4,050	—	18	2 15-ton, 10 6in., 5 Q.F., 9 M., 2 T.T.
Arethusa ..	C.	4,300	—	17	10 6in., 4 Q.F., 12 M., 4 T.T.
Inconstant ..	C.	5,780	—	16·2	10 12-ton M.L., 6 6½ in. M.L., 2 Q.F., 11 M., 2 T.T.
Iris	C.	3,730	—	18	13 5in., 4 Q.F., 7 M., 4 T.T.
Medusa .. Medea ..	C. 2cl.	2,800	—	20	6 6in., 10 Q.F., 3 M., 6 T.T.
Active	C. 2cl.	3,080	—	15·1	10 6in., 9 M., 2 T.T.
Barrossa ..	C. 3cl.	1,580	—	16·5	6 4·7in., 4 Q.F., 2 M., 2 T.T.
Basilisk	C. 3cl.	1,170	—	14·5	8 5in., 8 M.
Curlew	C. 3cl.	950	—	14·5	8 5in., 8 M., 5 T.T.

TORPEDO CRUISERS AND TORPEDO GUNBOATS.

FRENCH.

Name.	Class.	Tonnage.	Armour	Speed.	Armament.
Épervier .. Vautour ..	T.C.	1,272	—	17·4	5 4in., 2 Q.F., 2 M., 2 T.T.
Coulenvrine Dague Bombe Dragonne	T.G.	321	—	16	4 Q.F., 3 M., 2 T.T.

ENGLISH.

Mohawk Racoon Serpent	T.C.	1,770	—	17·	6 6in., Q.F., 2 M. 3 T.T.
Speedwell ..	T.G.	735	—	21	2 4·7in., 4 Q.F., 3 T.T.
Spider .. Sandfly .. Rattlesnake Grasshopper	T.G.	525	—	19	1 4in., 6 Q.F., 4 T.T.

We had 24 torpedo boats with our fleet; the French had 10 with theirs. Hence it will be seen that of the two fleets ours was immensely superior in every type of vessel except the harbour defence ironclads, and it should not be forgotten that we have in the Mediterranean (which the French have left absolutely without a fleet) a squadron of modern ironclads quite twice as powerful as the one lately mobilized in home waters.

Pessimists are fond of enlarging on the numerous accidents which happen to our men-of-war, but the following record will show that we have not quite a monopoly of misfortunes of that kind. The French fleet left Toulon on June 15th, and had only been out a few hours when the *Forbin* dropped out of line, signalling that the piston rod of her starboard engine was carried away. She had to go into harbour to replace it, and her services were lost to the squadron for several days. On June 17th the feed pumps of the *Dague* broke down, and she had to be taken in tow by the *Milan*. June 22nd was a desperate day; first the *Vauban* had to fall out with hot bearings, then the *Courbet* carried away her steering gear and was nearly 24 hours replacing it, and then the *Trident* found she could not keep up with the fleet, though they were only steaming 8½ knots in a flat calm and smooth sea. On June 26th the *Couleuvrine's* boiler tubes started leaking, and she had to be taken in tow by the *Redoubtable*, while the same office was performed for her sister ship the *Dague*, whose feed pump had again given out, by the *Courbet*. On June 27th the *Vautour* broke down and was unable to retake her station for more than 12 hours, and the next day the *Trident* did the same. The fleet was compelled to remain at Brest from June 29th till July 2nd making good defects, and they had barely got outside when the *Dague* broke down in the same way as before. On July 17th, when going out of Brest, the *Milan* struck on a rock and knocked a hole in her bottom 7 ft. long by 3 ft. in depth, and her pumps hardly kept her afloat till she could reach the docks. She was temporarily repaired in a most creditable manner by the dockyard, and rejoined the fleet in a little under three days, but there is no doubt that in war time she would have been practically a lost ship. On July 28th the *Epervier's* circulating engine broke down, and she was obliged to go into dock at Cherbourg, where her injuries were found to be so serious that she is not expected to be out of dockyard hands before September. It must be remembered that most of the accidents occurred to vessels which were not merely put into commission for the occasion with crews unaccustomed to the type of ship and engines, but formed part of the regular Mediterranean and Channel squadrons, so that their damages may be regarded as incidental to any well-found French fleet of the present day.

On the whole, the experiences of this squadron of manœuvres may be looked upon as distinctly encouraging to us, should we ever unfortunately be compelled to go to war with the second greatest naval Power in the world.

A despatch from Panama states that it is officially announced that the Government of Columbia has asked Congress to authorise the extension of the concession to the canal company on the terms proposed by M. Bonaparte Wyse.

Pig in Germany.—The production of pig iron in Germany in April was 398,457 tons. The corresponding production in April, 1889, was 372,742 tons.

Locomotives in France.—The Franco-Belgian Company has obtained an order for twenty locomotives for the Western of France Railway.

Kong Trygve.—On July 26th there was launched from the shipbuilding yard of Messrs Wood, Skinner & Co., at Bill Quay-on-Tyne, the second of two steel screw steamers, built to the order of Captain Dannevig, R.N., for the Sondensfjelds-Norske Dampskibsselskab, of Christiania. The vessel is of the awning-deck type, and has been designed for the purpose of carrying passengers and light general cargo between Christiania and Hamburg, and is built to the highest class of the Norwegian Veritas. During construction the vessel has also been superintended by Mr. Stenersen, the surveyor for the owners. The principal dimensions are :—Length, 178 ft ; beam, 27 ft. 6 in. ; depth, moulded (to awning-deck), 20 ft. 6 in. Ample saloon and state-rooms for first-class passengers are fitted up in 'tween decks amidships, having entrance from deckhouse forward of casing on awning-deck, where chart-room and smoke-room are also arranged. Engineers' and officers' accommodation is in 'tween decks abaft engine-room, and the sailors, firemen, and third-class passengers are berthed forward. The vessel will have water ballast in fore-and-after peaks, and in deep tank in after hold. Steam cranes are fitted on deck for dispatch in loading and discharging cargo. The engines have been built to Norwegian Veritas requirements, by the North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne. They are on the triple-expansion principle, and have cylinders 15½ in., 25 in., and 41 in., with 27 in. stroke, capable of propelling the vessel at a speed of 11 knots loaded. On leaving the ways the vessel was christened the *Kong Trygve* by Mrs. L. M. Bodin, of Sunderland. The firm have another vessel to put down in the place of the *Kong Trygve.*

The Shipbuilding Trade.—Overtime to be Stopped.—Mr. R. Knight, the general secretary of the United Society of Boilermakers and Iron Shipbuilders, in his monthly report for August, makes the following remarks on the position of his society and the state of the shipbuilding trade :—"Our returns to hand show that our members are well employed, as we have only 1,444 out of work, compared with 1,692 in the same week of 1888 and 820 in the corresponding week of last year. Taking into account the large increase of members during the last two years, numbering 6,000, the percentage of members now out of employment is only 4·1 compared with 5·78 in August, 1888. There has been a falling off in the number of orders for vessels of late, and this is not to be wondered at, seeing the large amount of tonnage put into the water during the past three years; and now the shipowners and ship managers are competing one against the other for freights, and the shipper is playing them off one against the other, and laughing at the cut-throat competition that is carried on. The shipbuilding trade on the north-west coast is briskly engaged, and there is still a good prospect of a large amount of work. The engineers of the north are keeping very busy, and there is no lack of work at present. During the month 292 members were admitted ; run out, 175 ; increase, 117. Platers and angle-iron smiths must not accept of any reductions in their piece rates. General reductions are enough, without suffering any intermediate ones. As there is a slackening off in the shipyards, and a few of our members discharged, we have consulted our district committees in the shipyard districts on the advisability of stopping overtime and night-shifts on new work in the shipyards, and they are very much in favour of this being done. We have, therefore, decided that all overtime as above mentioned must be stopped throughout the United Kingdom after August 13th, until further notice, and that no work is to be done either before or after the ordinary working hours. Any member violating this order will be fined 20s. for the first offence, £5 for the second, and be expelled from the society for the third. District committees and branches must see this order carried out Our members should be content with the ordinary day's work, without the overtime, and thus find employment for any unemployed members. Members on boiler work ought not to work more than quarters overtime." The accounts of the Boilermakers' Society, it may be added, show an increase of accumulated capital during the quarter of £13,584 18s. 11d., bringing the amount up to £127,688 5s. 8½d. The largest sum the society ever possessed before was £108,545 12s. 9d. at the close of 1883. The hope is expressed that trade will keep sufficiently good to enable them to reach £200,000.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 26th to August 25th, 1890:—

Cocks, Fredk. A., chief engineer to the *Philomel*, to date August 2nd.
Foreman, Felix, fleet engineer to the *Victoria*, to date August 14th.
Hawkins, Frank W., engineer to the *Nymphe*, to date August 4th.
Langmaid, Jos., chief engineer to the *Indefatigable*, to date August 5th.
Little, Edwd., chief engineer to the *President*, to date August 25th.
Liversidge, John G., assistant engineer to the *President*, additional, to date September 1st.
London, A. J., chief engineer to the *Indus*, additional, to date August 20th.
Madge, Henry A., engineer (temporarily) to the *Terror*, additional, to date August 14th.
Mayston, Robt., staff engineer to the *President* (lent), to date August 2nd.
Melrose, Jas., fleet engineer to the *Hibernia*, to date August 2nd.
Parsons, W. G., chief engineer to the *Warspite*, additional, to date August 4th.
Rabbidge, Wm., chief engineer to the *Asia*, additional, to date August 25th.
Sanders, J. S., chief engineer to the *Sybille*, to date August 20th.
Thorne, Charles W., chief engineer to the *Melampus*, to date August 14th.
Thorne, Thos., engineer to the *Indus*, to date August 2nd.

HOAR & BROWN'S HARDWOOD MARKET REPORT, August 25th, 1890.

Teak.—Low quotations appear to have induced business, and the deliveries from the docks continue good, although the demand in the shipbuilding trade is very quiet at present. There has been no considerable fall in the price of prime timber, but common or second-class woods can now be purchased at exceedingly low figures, and these latter quotations have had a very damaging effect upon the sale of the better stocks. The imports have lately exceeded the consumption, and the amount of tonnage taken up at shipping ports proves very much lighter than was expected. The arrivals for the remainder of the year will therefore be moderate, and prices may harden again for best qualities.

Of Teak planks there is a good supply, but prices have declined somewhat.

Mahogany.—Only one Tobasco cargo remains in first hands, and stocks are very considerably reduced, so that a substantial advance in prices may be expected. The deliveries have been exceedingly good, and include large quantities to H.M. dock yards.

There is an abundance of Cuba of small dimensions, but larger logs are wanted, and would command good prices.

The market is also well stocked with St. Domingo.

There is little Honduras, with the exception of crooked and inferior stocks; further supplies are not expected till late in September, and as the wood will not be ready for sale until October, full values will then be reached. The present aspect of the market has the appearance of a decided rise in prices for cargo averages, which will have the effect of raising the minimum, and for a time business is expected to be lively.

Cedar is slowly moving off, and the market is unchanged, or, if anything, shows a slight decline, and there is no prospect of improvement unless the anticipated rise in Mahogany should have some influence towards causing a partial advance in values.

American Sawn Walnut, White Wood, &c.—There appears to be an increase in the stock ; and this trade is making considerable progress.

Prices have not altered lately, but have the appearance of settling down to a uniform scale for the several classes. The fall in freights may bring large shipments again, when, perhaps, a slight weakness may show itself, but the major portion of the present stock being held principally by one or two firms, there is not much fear of prices receding.

Walnut Logs.—For purposes where width is essential, logs are finding buyers at outside prices, but timber of ordinary dimensions has not advanced in value, as imported boards and planks have largely taken its place.

Oak.—The general position of this market remains unchanged.

Greenheart.—There are enquiries about; but this market being so devoid of stock, nothing of consequence can result. A cargo is much required.

Padouk.—Both timber and planks are finding a fair market, and it is anticipated that this wood will have a good future, judging from the satisfactory reports received from the converters.

Kawrie Pine.—In consequence of a parcel being forced at a public sale without reserve, the prices are slightly easier. There is only a fitful market, and the stock is ample to last for some considerable time.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

Symptoms of a revived activity in shipping and ship building circles have happily characterised the latter end of August, and several most important contracts have just been secured by Clyde firms, while it is understood that several other companies are in the market for new steamers.

The British Indian Steam Navigation Co. have commissioned Messrs. Denny, of Dumbarton, to build a steamer of 5,000 tons, and it is understood that the same company have placed the contract for another large steamer with Messrs. A. & J. Inglis, Pointhouse, Partick.

A Liverpool firm of shipowners are understood to have placed the contract with a Clyde firm for three vessels, each of 5,000 tons.

The Clan Line Steamship Co., Limited, who have been in the market for some time for a number of large steamers, have just placed contracts for as many as six vessels. Four of them have been entrusted to a Clyde firm. Messrs. Stephen & Sons, of Linthouse, who it may be mentioned were the builders of the pioneer ship of the Clan Line fleet. One of the vessels has gone to Messrs. Harland & Wolff, of Belfast, and the sixth to a firm on the Wear.

Messrs. Russell & Co., of Port-Glasgow and Greenock, early in the month booked four separate orders for sailing ships, and they have since secured a fifth order. Those include a steel barque of 1,500 tons register for Messrs. A. & F. Smith, Tvedstrand, Norway; a steel barque of 1,700 tons for Mr. Klaveness, of Sandefjord, Norway; a steel ship of 3,800 tons deadweight for Messrs. Brunsgaard, Kjosterad & Sons, Drammen; and a steel ship of 1,700 tons for Messrs. T. Hughes & Co., Liverpool.

Messrs. S. & H. Morton, of Leith, have received an order to construct two iron steam hopper barges.

Messrs. Fleming & Ferguson, of Paisley, have received an order for the construction of two steam barges for the Japanese Government, to be used in connection with the harbour works at Yokohama. They will be fitted by the builders with their patent quadruple engines, to indicate 500 H.P., and will have heavy steam cranes on deck for handling concrete blocks.

Messrs. Simons & Co., Renfrew, have been entrusted with the order for a new patent hopper dredger, with a dredging capacity of 500 tons per hour, by the Nicaragua Canal Construction Co. This company have recently purchased the complete dredging plant of the Panama Canal Co. at Colon.

The 4th of August was a day of great activity in the Clyde shipyards, five large steamers, aggregating as much as 18,000 tons, having been consigned to the water. The largest vessel was the *Doune Castle*, of 4,000 tons gross, launched from the stocks of Messrs. Barclay, Curle & Co., Limited, for the Castle Line Mail Packet Co., of Donald Currie & Co. She is 410 ft. long, 43 ft. 4 in. broad, and 31 ft. deep, and has accommodation for 31 first, 42 second, and 80 third class passengers, while provision can be made for 400 steerage passengers if necessary. The *Doune Castle* is engined by her builders, and is splendidly equipped with every modern appliance for safety and comfort. She is the eleventh vessel built by the same firm for their owners, and a sister ship, to be named the *Lismore Castle*, is at present on the stocks. Another large vessel launched on the date named was the *Lanark*, from the stocks of Messrs. Russell & Co., for Mr. G. M. Steeves, of Liverpool. This vessel, which is 320 ft. long by 42 ft. 6 in. broad, and 28 ft. 6 in. deep, has a deadweight capacity of as much as 4,800 tons. Messrs. Dunsmuir & Jackson supply her with triple-expansion engines. A third vessel was the *Myridion*, approaching 3,000 tons, built and engined by Messrs. Scott & Co., Greenock, for the Ocean Steamship Co., Liverpool. Messrs. Scott have already finished two similar vessels for this company, and a fourth is presently on the stocks.

A somewhat apprehensive sensation was experienced by spectators at the launch of the *Doune Castle*, above referred to. When the vessel left the ways and became wholly water-borne, she heeled alarmingly to the port side, owing, it is said, to the strong outward current of the tide, but soon righted, and was immediately taken in tow. Though, happily, of momentary duration, this incident sent a thrill of apprehension through the spectators, and many were painfully reminded of the melancholy catastrophe which befel the *Daphne* five years ago, when launched from a neighbouring yard.

The annual inspection of the river and harbour works was made by the Clyde Trustees on the 19th ult., and as special interest attached to the visit on account of the large amount of work in actual progress and contemplated, a large company was the result. Besides present and past members of the Trust, the company included several Members of Parliament, and a number of leading shipowners and traders of Glasgow. The party was first conveyed by *Clutha No. 5*—one of the swift little steamers now doing henchman service up and down the harbour—to Finnieston Ferry, from which place, under the guidance of Mr. Deas, engineer to the Trust, the company visited the site of the proposed 130 ton crane, which the Trustees have resolved to erect to meet the growing requirements of engineers and shipbuilders on the north side of the river. Going on board the new elevating ferry steamer, which had been watched with curious interest on the way down by the strangers present, the party crossed the river to inspect the new Cessnock Docks. This gigantic undertaking is now well under way, and to those who had not before seen it, the process of making and sinking the cylinders of concrete which form the foundation of the quay walls, and the making of the ashlar blocks of which the quay walls are built, was especially interesting, while the practical men present bore emphatic testimony to the admirable character of the work in course of execution. Re-embarking on board the *Clutha* at Highland Lane landing stage, the visitors were conveyed down the river as far as Newshot Isle, immediately below the point where the river Cart falls into the Clyde. Here they were shown the line of the proposed widening of the river on the south side by the cutting away of some 60 feet of the bank. So much time had been occupied in examination of the operations at Cessnock that it was found impossible to continue the voyage to the Dalmuir Works; and the steamer accordingly put about and returned to the city, which it reached at five o'clock. The Trustees and a number of invited guests dined together in the evening in the hall of the Trust Buildings, Robertson Street, at which important speeches, relative to the development of the river, docks, and shipping were made.

During the third week of August the Junior Engineering Society of London paid a visit to the Clyde and West of Scotland, visiting many of the largest engineering, shipbuilding, and steel-making works in the district. Between thirty and forty members left London on the 15th, and after a brief stoppage at Newcastle, proceeded on the evening of the 16th to Edinburgh. On the 18th the members visited the Edinburgh Exhibition, and on the 19th an excursion was made to the Forth Bridge. Leaving Edinburgh on the 19th, the party next halted at Glasgow, the whole of the 20th being spent on the Clyde. On the 21st the members visited Denny's shipbuilding yard at Dumbarton, where the chief members of the firm received them. They were shown over the electrical department, and attention was also directed to the experimental tank, which was the object of special interest. Before leaving Messrs. Denny's yard the members were entertained at luncheon. On returning to Glasgow the Fairfield Shipbuilding yard and Engineering works were inspected, and in the evening the members sat down in the Grand Hotel, Charing Cross, to their first annual excursion dinner, which proved a marked success. Mr. P. J. Waldram (member of Council) presided, and amongst others present were Mr. W. Lily (member of Council), Professor Barr (Glasgow University), and Mr. Walter F. Dunn (hon. secretary of the society.) Next day was spent in visiting the works of the Steel Co. of Scotland at Newton and Blockairn, and the works of Messrs. William Arrol & Co. Saturday was devoted to a visit to the works of Messrs. J. & P. Coats, Paisley, and the party left for London in the evening, much delighted and edified with what they had seen.

Mr. Wm. Armstrong, for some years with Messrs. Palmer & Co., Jarrow-on-Tyne, has been appointed yard manager to the Fairfield Shipbuilding Co., Govan. His engagement, it is understood, is for three years; £800, advancing to £1,000, being the salary.

Mr. Wm. Cuthil, a gentleman well-known throughout the West of Scotland in connection with the mild steel industry, who was for many years associated with the Steel Co. of Scotland, and subsequently manager with the well-known and eminently successful firm of Messrs. David Colville & Sons, Motherwell, has just arranged to transfer his services to the Wear Iron and Steel Co., Limited, of Sunderland, in the capacity of general manager. Under his experienced guidance it may confidently be expected that this company will shortly take a foremost position in the mild steel industry on the east coast of England.

The Italian naval officials have evinced their readiness to adopt the most approved scientific methods in vogue in this country of conducting experiments, not only with finished ships, but with models of proposed vessels; and at Spezzia a fully-equipped experimental tank, such as is established at Portsmouth, and in the yard of Messrs. Denny & Co., of Dumbarton, is now a valued department in the dockyard there. The special apparatus used in recording the results of speed experiments with models was made in this country, and Messrs. Kelso & Co., Glasgow, who supplied the travelling carriage and dynamometers, the most essential part of this apparatus, are now engaged preparing three sets of apparatus for recording the speed of actual vessels while at sea. This apparatus was originally the invention of Mr. J. H. Biles, lately of Clydebank, and now of Southampton. The principle of the apparatus is the recording by means of pens electrically controlled, the speed attained by the vessel between floating objects thrown from the deck of the vessel herself. A set of these speed-recording apparatus has already been supplied to the Italian Naval authorities and experimented with: the present order for three additional sets being the result of these experiments.

The guarantee fund in connection with the proposed Industrial Exhibition for the east-end of Glasgow has now reached £6,000—£1,000 in excess of the figure originally proposed. There is, moreover, every likelihood of the fund reaching £10,000. The exhibition will include a valuable loan collection of art objects, and a series of lectures on educational subjects will be given during the course of the exhibition. It is to be held in a large building occupied until recently as an industrial institution at Dennistown, in the north-east district of the city.

Messrs. McInnes Bros., of Buchanan Street, Glasgow, are providing a magnificent silver vase for presentation to the Queen-Regent of Spain on the occasion of that royal lady's naming the first home-built Spanish cruiser. This vessel is to be launched from the British-Spanish naval yard in Bilboa on the 30th August. This establishment is managed by Mr. McKechnie, for many years of Clydebank.

MESSRS. R. & H. GREEN, of Blackwall, had trial trips of the two vessels they had built for the Bosphorus Steam Navigation Co., one on the 27th June, the other on the 26th ult. These two vessels are identical in design, paddle-boats fitted with Messrs. Penn's high-pressure oscillating type of engines. The dimensions are:—165 ft. by 21 ft., and 10 ft. moulded depth, the draft being 4 ft. 10½ in. mean. The material used is steel throughout. The engines have a surface condenser, and an independent centrifugal circulating pump. The boiler, of steel, is of extra size, and steam steering gear is supplied. The accommodation is for first and second-class passengers in fore and aft saloons. There is a ladies' cabin, and other private ones under the sponsons. Besides a promenade bridge and deck, there is a large clear space on the main-deck aft for the same purpose. The general appearance of these vessels is neat with two light rigged masts. The service for which they are intended is of a local character, for which they seem very well suited. The trials were both very satisfactory. As a mean of eight runs on the mile, with and against the tide, a speed of over 13½ knots was realised in both cases, the I.H.P. being just under 600, both vessels confer great credit on the builders. Everything was to the satisfaction of all concerned.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—During the month a more confident feeling appears to have been established in shipping circles, and inquiries have become decidedly more numerous than they were at any time during the preceding seven months. In a few instances contracts have been negotiated, but on terms which, with the high rates of wages still ruling, leave little chance of the realisation of a fair profit by the builders. It is very evident that the temporary recovery cannot have been caused by the condition of the freight market, which for weeks past has been characterised by abnormal depression, and we must therefore assume that nothing but the exceptionally low prices quoted by builders has induced shipowners to contemplate additions to their fleets at a time when employment for tonnage is none too plentiful. If this view be correct the recovery spoken of is merely a result of the speculative tendency which forms so marked a feature of modern commercial life, and is not to be relied upon as having any of the elements of stability. No genuine recovery in shipbuilding is likely to take place until the tonnage of the world is much more largely depleted than happens to be the case at present, though of course low prices must always materially assist in keeping a certain proportion of work upon the stocks. The announcement was made in the last issue of THE MARINE ENGINEER that the North-East Coast shipbuilders had given notice to the operatives for a 7½ per cent. wages reduction, to take place on October 1st, and to be followed by a further reduction of 7½ per cent. at the beginning of next year. With reference to this matter no further steps have been taken by the employers, though an intimation has been received from the Tees district of the Boilermakers' Society that the operatives would resist the demand. The employers, however, are not likely to abandon their claim through the mere fact of a few orders having been recently booked, and their determination to press their demand will certainly not be lessened by the circumstance that these contracts have been taken at exceptionally low rates, in the full expectation that a wages reduction would be submitted to. It is probable that some indication of the employers' course of action will be given during September, and it may be taken for granted that they will insist on their demand being acceded to in part, if not in its entirety.

The dispute, which for a long time past has been going on between the shipwrights and joiners as to the division of work between the two sections, has culminated in a general strike of the latter, which commenced on the 1st inst., and as yet shows no signs of being settled. The strike is causing injury of a more than ordinarily serious nature to the trade of the district, in proof of which it may be stated that Messrs. Wigham, Richardson & Co., who are engaged in effecting extensive repairs to a large passenger steamer belonging to Spanish owners, are being driven to the necessity of sending the vessel back to Spain to get the work of constructing and decorating the cabins carried out, the firm being unable to undertake the work here under present circumstances. If the strike continues many other important contracts must necessarily be driven away from the district, and while it lasts the employers will be seriously handicapped in competing for work. A quite unusual feature in the case is the circumstance that the employers are powerless to settle the dispute, as they cannot give the joiners what they want, even if willing to do so. It is only the shipwrights who can satisfy the joiners' demands, and that by abjuring the position assigned them under Mr. Burt's award. It may here be explained that the claims of both parties were by mutual consent submitted to the arbitration of Mr. Burt, M.P., and it is against that gentleman's award—which was accepted by the shipwrights—that the joiners are now on strike. It will thus be seen that their action is more than commonly open to censure, as they have repudiated a mode of settlement, to the introduction of which they were consenting parties. The silliness of their action, too, is most remarkable, as by no possible conjuncture of circumstances can they hope to win, and they must eventually—after they have done themselves and the district manifold injury—suffer the humiliation of relinquishing a position they should never have taken up. To come to the actual state of work in the different yards, it may be stated that the Palmer's Shipbuilding and Iron Co., Messrs. Wigham, Richardson & Co., Messrs. C. S. Swan & Hunter, and Messrs. Readhead continue to be the busiest firms on the river, and it may be added that the two last-named are among the firms who have recently booked orders. Messrs. Schlesinger, Davis & Co. have been commissioned to build a fast steamer for the Newcastle and London weekly run, and Messrs. R. Stephenson &

Co. have obtained an order from Messrs. M'Gregor, Gow & Co. for a steamer of large dimensions and quick travelling power, to be employed in the China trade. The war-sloop *Bellona*, which for many months has been standing in an apparently completed condition on the stocks of Messrs. Hawthorn, Leslie & Co., is, according to present arrangements, to be launched early in September. The fitting of the machinery on board has been carried out before launching, which, of course, is quite an unusual step in connection with steamship equipment. The firm are as usual very busy with repair contracts, and though the extensive and admirably-appointed shipyard has just now a somewhat deserted appearance, it is probable that in the course of a few weeks some approach to the ordinarily busy aspect of the establishment will be presented. Both the Elswick and Low Walker yards of Messrs. Armstrong, Mitchell & Co. are still very slack, but at the Tyne Shipbuilding Co.'s yard, and also at Messrs. Wood & Skinner's, business keeps pretty active.

Engineering.—In reply to an inquiry, one of the leading engineering employers in the district states that "new work is exceedingly difficult to obtain, and what there is can only be contracted for at unremunerative prices. The prospect for the manufacturer is consequently very unsatisfactory, especially in view of the facts that prices of materials are again rising, while wages remain at the unprecedentedly high point attained last year." The same authority gives expression to the opinion that a reduction of wages must necessarily soon take place, but it may be added that no notice of such has yet been given by the employers. The antagonism of the operative engineers' society to piecework has, in this district, just emerged from the passive to the active stage, and has become very distinctly aggressive. appears that since the starting of the Wallsend Slipway and Engineering Works some 16 years ago, a system of piecework has been employed in some of the departments, which is and has been perfectly satisfactory to both the firm and the men connected with the works. It would seem, however, that the operatives in the other engineering establishments consider themselves entitled to dictate as to the way work has to be carried on at the Wallsend Slipway Works, and it is said that they contemplate putting a stop to the system at the works mentioned, which for 17 years has been mutually satisfactory to both masters and men. It is quite clear that this is an unjustifiable interference in other people's business, but that it is doomed to failure may be inferred from the facts that the Slipway workmen have the support of their society's rules for the position they have taken up, which is one of complete agreement with the firm, while the firm have in their favour the terms of settlement entered into between the employers and the workmen's representatives some months ago, which provided among other things that the question of piecework should be left to be settled between the employers and employed in the different works. Messrs. Emerson, Walker & Thompson Bros., Limited, continue to have a large amount of work in their various departments, and Messrs. Watson & Sons, of the High Bridge Works, Newcastle, are also having plenty of work, a large proportion of which consists of pumps, fire-engines, side-lights, and other steamship accessories. Ironfounders are generally well off for orders, and forge proprietors have mostly a good supply of work. Messrs. Noble & Lund have recently effected an improvement in their well known angle bending machine, by which the rollers can easily be adjusted to deal with any thickness of iron or steel angle bars. Among other contracts the firm have now in hand an exceptionally large planing machine for a South Shields engineering works.

Electric Lighting.—The splendidly-appointed passenger steamer *Grand Duke Alexis*, built by Messrs. Hawthorn, Leslie & Co. for the Russian Steam Navigation Co., has been lighted throughout by Messrs. J. H. Holmes & Co., who are also lighting the sister ship *Grand Duke Constantine*. The generating plant consists in each case of a No. 15 "Castle" dynamo, coupled direct to a compound, side by side, vertical engine running at 250 revolutions per minute. The engines are fitted with the "Acme" governor to maintain a constant speed under varying loads, and the dynamos are "compounded" to maintain a constant electro-motive force. The relative speed and voltage for "no load" and "full load" do not vary more than 3 per cent. The installation is carried out on the "single wire" system, in which the hull of the ship is used as the "return" for the electric current. Messrs. Holmes's extensive experience in ship lighting has shown them that this is in all respects the best system to adopt. The fittings in the first-class portions are all silver plated, a number of them having been specially designed to meet the requirements of the saloon, where the lamps are arranged in horseshoe form, and have cut-glass globes of elaborate pattern. The saloon lamps are controlled by switches placed in the steward's pantry. In each berth a switch is placed on the door frame, by which arrangement the light can be turned on immediately the door is opened. In the second-class all the fittings are polished brass, and are very neatly designed. Portable table lamps are furnished in the captain's, chief officer's, and chief engineer's berths in addition to the fixed lights, arrangements being made to keep them in position in rough weather. Messrs. Holmes pay particular attention to the wiring of the engine and boiler spaces. In these parts of the vessel, as also in the tunnel and all exposed places, iron-sheathed or lead-covered wire only is used, and in the boiler spaces the wires are both lead-covered and iron-sheathed, wires so protected being practically indestructible. These wires, instead of being laid in wood casing, are fixed to the steel bulkheads by wrought-iron clips, secured by tapped screws. Here also only strong iron watertight fittings are employed. Lights are fixed immediately under the cylinders to light the moving parts of the engine, and a few portable hand lamps are provided, which can be used to inspect the inside of the boilers, or any part where the placing of a fixed light is impracticable. Each signal lantern contains two 16-candle power lamps, and are all controlled from switches placed in the wheelhouse under the bridge. The masthead lantern is rigidly fixed to the mast, and the conducting wire, which is lead-covered and iron-sheathed, is led up inside the mast. This is so arranged that in the event of it becoming necessary to replace the wire, the work could be done in a few minutes. Portable cargo lanterns, each containing eight 16-candle power lamps, are provided for each hatch. The whole installation was, on completion, running continuously for 12 hours, to the complete satisfaction of the owners' superintending engineer, and the steadiness of the light was remarked upon by many of the visitors. It may be added that every wire on the ship is easily accessible, and with a view to minimise the possibility of any disturbing influences being produced no single wire is run within 15 ft. of the standard compass. Other precautionary measures have also been taken to effect the same purpose, and in every detail of the installation the most painstaking care has been expended to ensure the best possible results.

THE WEAR.

Shipbuilding.—The Executive Council of the Boilermakers' and Iron Shipbuilders' Society have issued an order against the working of overtime or night shift by the members engaged on new work, and it came into force on the 13th inst. The order has, as a matter of course, been rigidly carried out, and one firm, it is understood, has been seriously inconvenienced in consequence. As a rule, however, the restriction has not, up to the present, materially interfered with the arrangements of shipbuilders, who generally have no more work than can be done very conveniently in the ordinary working hours. Such restrictive measures, however, are always vexatious, and are often as objectionable to the men in whose interests they are supposed to be propounded, as they are to the employers, against whom they are directly levelled. At the North Sands yard appearances are indicative of a pretty busy time coming. In addition to the vessels that have been some time on the stocks, two keels have recently been put down, and both framing and plating material is being received in considerable quantities. The Sunderland Shipbuilding Co., and Messrs. Bartram & Haswell have each commenced the framing of a vessel lately, which circumstance has, in each case, improved the outlook for the future. Messrs. Austin & Son are repairing in their graving dock the locally-owned steamer *Ottercaps*, which was driven ashore near the entrance to Sunderland South Docks early in the month. Messrs. R. Thompson & Sons continue to have their Bridge Dock pretty regularly occupied with vessels undergoing repairs or painting, &c. The steam trawler *Lincoln*, which was launched from the building berth connected with the dock, some few weeks ago, has, it is understood, since being put into work, given very special satisfaction to the owners. Messrs. Laing has launched this month a handsomely-finished passenger steamer for French owners, and Messrs. Doxford have put off the stocks the first of two vessels ordered by the British Steam Navigation Co. The second vessel is in an advanced stage of plating, and will probably be launched in October. The firm have during the month commenced the framing of an exceptionally large vessel, the construction of which is to be proceeded with as rapidly as circumstances will permit. Messrs. Osborne & Graham and Messrs. Pickersgill are each said to have booked orders lately, and at Messrs. Priestman's and Messrs. Short Bros., all berths are occupied.

Eratum.—In our last number we credited Messrs. R. Thomson and Sons with having contracted for the building of a large oil ship and also of having sold the vessel which they have building on the stocks. We have since learned that such was not the case.

Engineering.—The whole of the marine engine works keep well employed, and in one or two cases new orders have been received to supplement those already in hand. Overtime is still being resorted to, but not to so large an extent as at an earlier period of the year. Iron founders are still able to keep their places going steadily, and those who are in a position to produce the heavier class of castings have recently increased the quantity of work in hand. In the forges business has improved, and both rivet works and chain and anchor works are rather more active than they were a few weeks ago. A demand for a seven-hour shift from "bank to bank" has been put forward on behalf of the miners throughout the county of Durham, and the strike in respect of the same, which has hitherto been confined to Monkwearmouth Colliery, may soon be extended to the wide area indicated. Meetings have been held between the representatives of the coal owners and the miners, at which the question has been discussed, but up to the present no settlement has been arrived at.

The Hartlepools.—The whole of the shipbuilding firms keep fairly busy, repair contracts constituting a considerable proportion of the work in hand. At Messrs. T. Richardson & Son's engineering establishment work has been carried on during the month with the customary activity. Part of the machine shop is undergoing an extensive alteration and extension. This is the last remaining portion of the original works, and it has been out of keeping with the large and lofty buildings which constitute the newer portion of the establishment. The extensions which from year to year have been gradually carried out have resulted in making the establishment worthy of ranking among the most spacious and best arranged in the country. The machinery is capable of dealing with the heaviest marine engines now built, and it has been laid down with an aim to the most expeditious execution of work. The new alteration is being carried out by Messrs. T. Richardson & Son's own men, the material being supplied by local contractors. In this way it is hoped that the whole will be completed without interference with the working of the existing machines. When completed the alteration will give a clear length of machinery in one bay of 361 ft. This bay is served by four travelling and several jib cranes. Light railways run between the several lines of machines, and everything has been arranged with a view to give the utmost facility in the transport of work from one part to another. Considering the very effective character of the working facilities provided, there can be no doubt that in the dull time, which sooner or later must inevitably come, Messrs. Richardson will be in a position to compete favourably with most kindred firms.

At the Central Engine Works of Messrs. William Gray & Co., Limited, there appears to be no falling-off in the output of marine engines, and indeed the past month gives a record of an exceedingly smart piece of work in the way of engining a vessel. The s.s. *Bushmills*, originally named the *Halifax City*, a vessel built by Messrs. Edward Withey & Co., and having engines of 1,000 I.H.P., was put under the sheerlegs at the Central Engine Works at ten o'clock on a Wednesday morning to receive her machinery, and was engined complete with boilers, engine, shafting, propeller, pipes, &c., including all the flooring, ladders and grating usually provided in an engine-room of this size; steam got up, and the engines steamed for three hours at the sheerlegs, and returned to the shipyard at 10 a.m. on the following Saturday, making precisely three days in which the whole of the foregoing work was executed. Amongst the vessels that have had their trial trips and proceeded to sea is the *Kingsland*, which was built by Messrs. W. Gray & Co., for Messrs. Watts, Ward & Co., of London; the *Halifax City*, built by the same builders for Messrs. Mark Whitwell & Son, of Bristol, and transferred to the Furness line of steamers; the *Manchester*, built by the same builders for Messrs. Evan, Thomas Radcliffe & Co. of Cardiff; and the *Bushmills*, previously alluded to. The principal feature of the month, however, was the trial trip of the s.s. *Rangatira*, the largest vessel yet built at the Hartlepools. She is 400 ft. long, 47 ft. wide, 29 ft. 4 in. deep, and carries 6,300 tons deadweight. The vessel, which is owned by Messrs. Shaw, Saville & Albion Co., Limited, of London, goes on their New Zealand line of steamers for the conveyance of frozen meat to this country. She will carry the astonishing total of 70,000 sheep carcasses, and will steam 10½ knots loaded. The vessel is fitted with loose-bladed manganese bronze propeller, cast at the Central Engine Works, the manufacture of which is being made a speciality at this establishment. On the trial trip the vessel was put four times over the measured mile, and recorded a mean speed of 11½ knots. On the run to London, however, she made an average speed of 12 knots, doing the distance between Hartlepool and the Royal Albert Dock in 24½ hours. This appears to bear out the view that measured mile speeds over a single mile are apt to give results short of the vessel's speed owing to various causes, of which perhaps the most important are (1) that the ship after turning at the completion of the mile may not be fully under way, when entering the next mile; and (2) that it is difficult to steer over a mile on precisely the correct course, at all events without giving the ship considerable rudder, and this, with the use of steam steering gear, results in much interference with the action of the propeller. The speed of this vessel at all events was eminently satisfactory to all concerned, and is higher than was anticipated by the builders. The trial was carried out with an entire absence of hitch or trouble in the engine-room, no water having been applied to any bearing, and no necessity to slacken speed having arisen during the whole run to London. This vessel is so much larger than any previously built at the Hartlepools that her construction at this centre has only been rendered possible by the enterprise of Sir Wm. Gray in opening out a new yard, large enough to admit of the building of vessels up to 500 ft. in length. She may indeed be regarded as a new departure in shipbuilding at the Hartlepools, and is doubtless the forerunner of many other vessels, which will include the largest type required in the merchant service. There is just now under the sheerlegs at the Central Works a sister ship to the *Rangatira*, named the *Tekoa*, which is also intended for employment in the New Zealand dead meat trade. The new forge at these works is now practically in full swing, and the output of forgings is fast approaching a total of 200 tons per month.

Stockton.—Both shipbuilding and engineering establishments at this centre keep busy, the chief among the latter, *i.e.*, Messrs. Blair & Co.'s, continue to maintain a very large output. Since July 19th the following vessels that have been engined by the firm have had their trial trips:—the s.s. *Etona*, built by Messrs. Richardson, Dnck & Co., of Stockton, for Messrs. Bucknall & Son, of London, with engines of 200 H.P., having cylinders 22½ in., 37 in. and 61 in., by 42 in. stroke; the s.s. *Oswald*, built by Messrs. Turnbnll & Son, of Whitby, having engines of 140 H.P., with cylinders 20 in., 33 in., and 54 in., by 36 in. stroke; the s.s. *Pakeha*, built by Messrs. Ropner & Son, of Stockton, for Messrs. The Shaw, Savill & Albion Co., Limited, London, having engines of 150 H.P., with cylinders 28 in., 46 in. and 75 in., by 48 in. stroke. The whole of these engines are constructed to work at 160 lbs. pressure of steam, and on their trial trips were found to be entirely satisfactory.

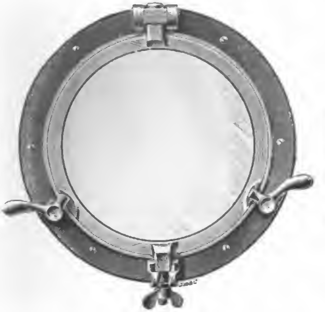
Middlesbro'.—Shipbuilding at Middlesbro' continues fairly active, and it is reported that some new orders have recently been booked. Engineering establishments also keep pretty busy, and in some cases important contracts are held. Foundries are very actively employed, and at the steel works briskness is still the rule. Manufacturers of steel plates and angles are well supplied with orders, and in connection with this trade no slackness need be apprehended for some time to come.

Darlington.—The Darlington Forge Co. have just successfully cast the third and last cast-steel double bracket for the Canadian Pacific steamers. These will be among the heaviest finished steel castings yet turned out by any maker, their weight being 28 tons each from the foundry. The brackets measure 21 ft. 10 in. over all, and have bosses at each end which are 32 in. diameter and 8 ft. deep.

ACTIVITY IN THE CLYDE SHIPBUILDING TRADE.—A Glasgow correspondent says: There is quite a spurt in the Clyde shipbuilding trade, and to-day it is made known that several vessels of large tonnage have been placed. For the Clan Line Messrs. Stephen & Sons, Linthouse, Glasgow, have contracted to build three of six steamers of large tonnage, the other three having gone to the Tyne. Then, again, four vessels of 5,600 tons each have been placed for the British India Steam Navigation Co., two with Messrs. Denny Bros., Dumbarton, and two with Messrs. A. & J. Inglis & Co., Pointhouse, Glasgow. They are intended for the Queensland trade, and will make 15 knots per hour. Two sailing vessels of 1,800 tons burthen for Hamburg owners have gone to Messrs. Charles Connall & Co., Scotstoun, Whiteinch, Glasgow; and two powerful dredgers to Messrs. Ferguson & Co., Paisley, for the Japanese Government. Other new vessels are under negotiation. These new orders, together with those secured in the lowered reach of the Clyde, should very materially help to fill the many vacant berths in Clyde yards.

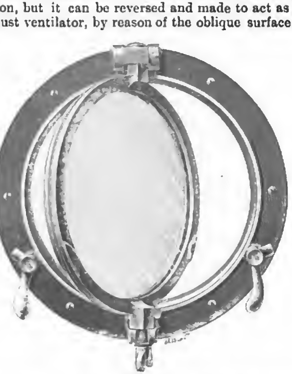
BROADFOOT'S PIVOTING SHIP'S SIDE-LIGHTS.

HOWEVER efficient and well contrived any general system of passenger ship ventilation may be, the element of individual requirement or taste will always intervene, where there is a large number of passengers, to render such general systems either too imperative or too pronounced, according to the variation of temperature and weather on a protracted voyage. Any device, therefore, which can supplement the ordinary general systems in use, and especially anything which admits of the passengers having individual control over it, is worthy of consideration and adoption. A very noteworthy example in point has come to our notice in the shape of "pivoted" side scuttles, as patented and made by Messrs. John Broadfoot & Son, Finnieston Street, Glasgow. Pivoted side-lights are not exactly a novelty, but in the case of the lights under notice the principle has been carried to admirable perfection.



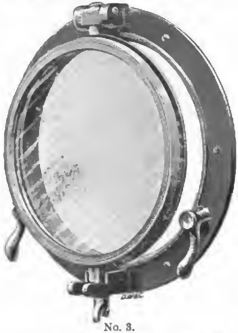
No. 1.

Figs. 1, 2, and 3 illustrate this light in, it is hoped, a sufficiently clear manner. From these it will be seen that while the fixed frame does not differ in any essential way from the fixed frames of ordinary side-lights, the opening or glass frame is hinged from the top, and has the fastening screw and nut at the bottom. Projecting upwards from the top of the glass frame is a short spindle, which passes loosely through a square unscrewed nut, having at each side projecting circular pivots, which rest and revolve in corresponding bearings in lugs, which are cast on the fixed frame. While the square nut with its side pivot—or, as this may be better named, the crosshead—is firmly fixed, except against hinging motion, the glass frame with its top spindle is free to revolve, the spindle being the axis of rotation. Thus, by merely loosening the bottom fastening-nut, the glass frame may be made to pivot round to any degree of obliquity relative to the fixed frame or ship's side, and at any position may be refastened. The advantages of having a side-light which can be so manipulated are obvious. Not only can fresh air be admitted by fixing the pivoting frame to suit the circumstances of direction of wind and ship's motion, but it can be reversed and made to act as an exhaust ventilator, by reason of the oblique surface of the glass intercepting the wind, and causing a vacuum behind it.



No. 2.

Should the passenger be averse to any strong draught, the pivoting light can be turned completely outside in, and when fixed in this position there is an aperture all round the circumference of an inch or so.



No. 3.

The whole glass frame can of course be opened and held up horizontally by the usual catches. This form of side scuttle admits of dead lights being fitted in the ordinary way, or it can be made to have a thin dead light inserted against the outside ledge of the fixed frame, and jammed tight by the pivoting frame. These unique and serviceable side-lights have been adopted on board the passenger steamer *Frederica* and sister vessels built and building by Messrs. J. and G. Thomson, Clydebank, for the London and South-Western Railway Co., for service between Southampton and the Channel Islands. The three large Canadian Pacific Mail steamers, presently building by the Naval Construction and Armaments Co., at Barrow, are also being fitted with them, and there is every likelihood of their use being greatly extended whenever owners desire to provide efficient state-room and saloon ventilation.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—The shipbuilding trade of Barrow and the district has undergone no material change during the past month. It is a fact that with one exception no new orders have been booked, but that order is one which, although of minor importance, is such as large shipbuilding yards like to acquire with a view of keeping men together when greater contracts are in contemplation. The Naval Construction and Armaments Co. have been entrusted with a contract to build a dredger for the Danube. Important negotiations are pending with a view to the acquisition of contracts of considerable magnitude for steam shipping; but the disposition of shipowners at the present time is not to place out orders that they can avoid, because there is such a large tonnage of shipping unemployed throughout the world, and freights are not such at present as will justify hopes of profitable trade being done by any new ships that may be built. Some considerable progress has been made with work in hand in the district. As launch after launch takes place, there is an increasing scene of activity in the Devonshire Dock, at Barrow, where a large marine engineering trade is done. At present there are three large steamers in this dock receiving triple-expansion engines, and there are also the *Latona* and *Melampus*, two of the three cruisers built at Barrow for Her Majesty's Government. The engineering, boiler-making, and iron foundering departments of the trade are very busily employed night and day, and have prospects of good orders for work before them. One of the most interesting features of the marine engineering trade of Barrow is the strikingly varied classes of engine work which are being carried out. Our correspondent the other day had the opportunity of seeing the starboard engines of the twin-screw cruiser *Melampus*, and the port engines of the twin-screw Canadian Pacific Railway Co.'s steamer *Empress of India*. The former engines, in pairs, will develop 9,500 H.P. and the latter 10,000 H.P., and yet there is no comparison in their size. The engines of the *Empress of India* will at any rate represent double the weight of those of the cruiser, although the power they are to exert is only 500 horses more. They are taller and have heavier castings, longer stroke and stouter machinery in every sense. The object of the Admiralty in this matter is to secure the maximum of strength in their engines with the minimum of weight, while that of the owners of the Great Pacific liners is to secure good substantial engines capable of considerable power at a high rate of speed for a fortnight at a time together. It is obvious that the principle of building twin-screw boats for large ocean-going steamers is gaining favour, inasmuch as with the high pressures boilers now used the twin-screw triple-expansion engines are an undoubted economy, and it is just on the cards that some large steamers now engaged in the shipping trade will at any rate be tripled before next season comes in. Some peculiar developments have taken place in the steel shipbuilding material trade during the month. Local manufacturers of plates, angles, &c., have been thrown out of the market to a great extent by the cheap quotations of East Coast and Scotch makers of Siemens'-Martin's steel. Last month the quotation for plates was £6 15s., now it is £6 5s.; and angles were £6 5s. and are now £5 15s. But one of the largest of the East Coast firms has sold large parcels of plates delivered at Glasgow at £6 5s. per ton less 5 per cent., or equal to £5 9s. per ton net. It is noteworthy that, even with shipbuilding material so cheap as this, shipping owners cannot be induced to order tonnage to any large extent.

Whitehaven.—The shipyard at this place is still idle, and the efforts made by the directors to sell it have been fruitless up to the present, and in the present state of trade they are likely to be so.

Workington.—There is a steady trade in shipbuilding at Workington, but the craft building represents but small tonnage. The West Cumberland Iron and Steel Co. have ceased to produce plates and angles and other sections at present owing to the difficulty they have in making profits.

THE MERSEY.

THE condition of the shipbuilding industries of this district remains much the same as we have reported now for several months past; work in hand in most cases being rapidly completed without being replaced by new orders, and in some instances there is every prospect that before very long works will have little or nothing in hand to go on with. In fact at one of the ship yards the last vessel on the stocks is now approaching completion, and the firm have absolutely no new orders whatever to take in hand after this vessel has been launched. With a view of keeping their yard going and their men employed, we understand that a proposal has been put forward that the firm would lay down a large sailing ship to build on speculation, provided the men were willing to accept a reduction in wages, which would enable the firm to build the vessel at a cost which would give them a reasonable chance of finding a purchaser without incurring an actual loss to themselves on the vessel. This proposal, however, the men seem to have declined to entertain on the ground that they would not be allowed by their society to accept work at anything under the present full rates, even though the result of such a refusal would mean their being thrown out of employment. So far as the prospects of new work are concerned there are very few inquiries coming forward, and even where a disposition is shown to place out new vessels the prices which are offered are so excessively low that their acceptance is quite out of the question. Customers seem to expect that the considerable fall in the price of material which has taken place since the commencement of the year should represent an all-round reduction in the cost of the vessel, apparently disregarding altogether the fact that labour, which is a more important item than even the cost of material, has in no way receded. In fact so far from wages at all receding, there are still new stipulations and demands of one sort or another being put forward by the men, which all mean an increased cost of production. One of the most recent illustrations of the uncompromising attitude the men are taking, notwithstanding the evident decline of activity in trade, is an intimation that has been sent out from the Shipbuilders' and Boilermakers' Society that in future they will not allow apprentices to work on repair jobs. For years past it has been the unquestioned practice to employ a certain proportion of apprentices on work of this description, and if the men are to insist that it shall now be discontinued, it will necessarily mean a largely-increased cost of such classes of work. So far the men seem to have limited any definite action they have taken in this matter to Messrs. Laird & Co., of Birkenhead, advantage being evidently taken of the large quantity of Government and other work which the firm have in hand to impose still further unreasonable conditions upon the employers. The action which the Shipbuilders' and Boilermakers' Society have taken with regard to Messrs. Laird & Co. has been intimated to other firms in the district who would be affected by this new restriction upon labour, and no doubt the matter will be taken into general consideration with a view of deciding whether it shall not be resisted by some combined action on the part of the employers. The conditions with regard to labour under which shipbuilders are still placed of course makes it extremely difficult for them to tender for any new work that may be coming forward; such new work would only now be obtainable at the very lowest possible prices and with the present rate of wages could not be secured with a prospect of any remunerative return whatever to the employer. It seems probable therefore that the unreasonable attitude taken by the men will have the effect of preventing the acceptance of new work until employers are enabled to place themselves upon some more favourable conditions. So far the men seem still to have command of the situation, the activity at Messrs. Laird's shipbuilding yards, and which is likely to continue for a considerable time to come, of course very materially strengthens their position, and as they evidently anticipate that some action with regard to reducing wages may before very long be taken in the Liverpool district, they are adopting a policy of restricting the number of workmen obtainable. The result is that although one large engineering works at Liverpool is at present being dismantled and sold off by auction and many others are not more than indifferently employed, there is as great a difficulty as ever in obtaining workmen when they are required. The returns issued during the past month by some of the trades-union organisations connected with the engineering industries would seem however to show some indications that this policy is scarcely likely to be successfully carried out for any lengthened period. Although the reports from the principal industrial centres still return trade as good, there is an evident slackening off so far as new work in prospect is concerned and decidedly less pressure to complete orders that are in hand. As a result night shifts, which have been very generally resorted to for some time past, are now in a great many cases being discontinued, and the Amalgamated Society of Engineers has at length to report a slight increase in the number of unemployed members on its books, whilst there is nothing like that pressure of inquiry for workmen which has been experienced of late. The number of actually out-of-work members, it is true, continues exceptionally small, the percentage for the whole of the society being still scarcely 2 per cent., whilst in the Steam-engine Makers' Society it is scarcely more than ½ per cent., but the outlook so far as continued full employment is concerned is not nearly so satisfactory. In view of this undoubted change in the condition of trade, employers, though they are unable just at present to take any decided steps in the way of reducing wages, are looking forward to the opportunity when the cost of labour may be put on to something like a legitimate footing which will enable them to seek after work with some degree of confidence. For the present however the actual situation remains most satisfactory and the development of further events is in many quarters being looked forward to with some anxiety.

The shipbuilding yards on the Liverpool side of the Mersey are still simply kept going with vessels which they have had in hand for some time past. Messrs. T. Royden & Sons are going on with several vessels, of which particulars have previously been given, and these are approaching completion, with little or nothing new coming forward. Messrs. W. H. Potter & Sons are on the point of completing the last vessel they have on the stocks, and they also report no new work in prospect. On the Birkenhead side Messrs. Laird & Co. are kept very busy with various important contracts they have in hand, the principal of which is the large line-of-battle ship, the *Royal Oak*, work upon which is progressing very satisfactorily. During the month a series of progressive trials have been made with the high-speed engines on the torpedo gunboats recently launched, and of which we have given a full description. These trials, we understand, have given very satisfactory results. The firm have also carried out further work on the *City of Paris* in getting her ready to receive her new engines when she is sent over to the Clyde. So far as shipbuilding altogether is concerned, any new work going out is chiefly in repairs or in replacing more modern high-pressure boilers for those which have previously been on the vessels, and this keeps some of the engineering and boilermaking shops fairly busy, but so far as new ships are concerned there is practically nothing of any moment giving out. Engineers in most cases report a decided slackening off as regards general marine work, and where they are kept busy it is chiefly upon either special foreign orders or miscellaneous plant altogether outside shipbuilding requirements.

The past month has witnessed a strong upward movement in all descriptions of pig-iron, some brands having advanced quite 5s. per ton. There is, however, a very general feeling that this last rise in the market has been due in very great measure to speculative operations and not to any actual improvement in trade. The buying has been chiefly coming forward from merchants, no doubt in anticipation of a further upward movement in prices consequent upon labour difficulties and other contingencies outside legitimate requirements for actual consumption, and a very considerable business has been done. Consumers, on the other hand, have not been buying at all largely, and although in many cases they would now be willing to buy forward at old rates there is no disposition to follow the present advance, and as a rule the chief users are well covered for present requirement. Business has been done in foundry pig-iron at about 51s. for Lancashire, 50s. 6d. for Lincolnshire, and from 50s. up to 52s., according to brand, for Derbyshire, less 2½ per cent., and makers are now generally holding out for quite 1s. per ton above these figures. Outside brands have also stiffened up considerably, Eglinton delivered at the Lancashire ports being now quoted by makers at 54s., and equal to Manchester at 58s. 6d., with good foundry Middlesbro' firm at 54s. 4d. net cash.

In the manufactured iron trade there has also been more business giving out, and forges are generally well employed, but in most cases it is still chiefly from hand to mouth, and there is certainly no sufficient improvement in this branch of trade to warrant manufacturers following the upward movement that has taken place in new material; makers are not taking such low prices as have been accepted recently, but there has been no really substantial advance upon current market rates and delivered in the Manchester district, good ordinary qualities of bars can still be got readily at £6 7s. 6d. to £6 10s. Hoops are firm at £6 12s. 6d. to £6 15s., with sheets, which have stiffened up more than any other description, quoted at £7 15s. to £8 per ton.

The metal market continues very firm, owing to the steady advance in new material, and manufacturers, who are all well supplied with work, are indifferent about booking orders at their full list rates, upon which it seems likely there may be before long some advance. Customers, who have hitherto been holding back from buying at present rates, are now giving out their orders more freely, as they see no advantage in further waiting. For delivery in the Manchester or Liverpool district quotations are as under:—Solid drawn brass tubes, 8¼d. per lb.; solid drawn copper tubes, 9¾d.; brazed copper steam tubes, 9½d.; brazed brass tubes, 9¼d.; brass wire, 7¼d.; copper wire, 9d.; rolled brass, 2 in. to 12 in. wide to 30 w.g., 7d.; rolled brass alone, 12 in. wide to 18 in., 28 w.g., 7½d.; sheet brass, 24 in. by 48 in., 8 lbs. and upwards, 8d. per lb.

Nut and bolt makers still report only a very limited weight of work giving out, and to secure orders they have to make further concessions upon their list rates.

The principal boilermaking firms throughout the Manchester district are all very busy upon work, not only for inland purposes, but on small marine boilers, where these are made a speciality, and there is plenty of inquiry in the market to indicate no scarcity of new work coming forward.

In the steel trade there has been a steady hardening up in prices during the past month both in raw material and in most descriptions of manufactured goods. Hematites have now advanced to even 67s., less 2½ as the minimum for good foundry qualities delivered in the Manchester district, whilst ordinary steel billets are quoted at £5 9s. 6d. delivered here, and business has been done at close upon these figures. In steel plates good boilermaking qualities have shown a substantial hardening up in price, the leading makers not now quoting under £8 2s. 6d. for delivery to consumers in the neighbourhood of Manchester or Liverpool, and small orders have been booked on about this basis. In steel ship plates, however, the business coming forward generally has been of the most meagre description, any inquirers upon the market being for very small quantities, and even for these sellers have competed so keenly that they have only been securable at extremely low figures. Nominally £7 5s. to £7 7s. 6d. is being quoted by makers for steel ship plates delivered *ex* steamer *Liverpool*, but these figures are quite out of the market, and orders of anything like weight could no doubt be placed readily at about £7 per ton.

In the timber trade imports of most articles during the month have been too heavy; the deliveries, however, have been fair, and a considerable quantity of the recent arrivals will go direct from the quay into consumption. Several of the leading articles have slightly given way in value, but prices on the whole have been fairly maintained. Still, however, if the market is to maintain any firmness, a restriction of shipments will be necessary.

In the coal trade the dispute at Cardiff during the past month has temporarily had the effect of throwing an extra quantity of business into the ports on the Mersey, vessels going there to secure supplies which they have hitherto obtained from South Wales. This, for the time being, caused a rise in prices, and on special coals, for prompt delivery, as much as 11s. per ton has been got for steam coal delivered at the High Level, Liverpool, or the Garrison Docks. The shipping trade is still active on the Mersey, but there is not that pressure of orders upon the market, and the prices have got back to something like 10s. to 10s. 6d. per ton for good ordinary descriptions of steam coal delivered at the ports.

A DESPATCH from Greytown announces that the Nicaragua Canal Construction Company has purchased the Slavin plant used on the Panama Canal, including dredgers, lighters, tug-boats, machinery and tools. The plant is now on the way to Greytown.

THE EFFICIENCY OF FIRE-BARS.

So many experiments have been made from time to time with different kinds of fire-bars, all claiming to be improvements on existing types, and generally with unsatisfactory results, that an apology is almost necessary in drawing attention to a new claimant for notice in this field. There are, however, many considerations connected with the general subject of fire-bars in relation to fuel consumption, which, when properly understood, will render the attention devoted to this special case excusable if not amply warranted. In estimating the relative value of the many forms of fire-bars, introduced with the avowed object of a better consumption of fuel, it has not always been borne in mind what are precisely the objects sought to be attained, and what are really accomplished. A mistake commonly made, leading to very false results, is the precipitate way in which many owners and engineers testify to the efficiency of new types of bars, showing for a short period evident economy, but which are in time found quite as inefficient, if not more so, than those previously in use. For example, the owner of a steam boiler has reason to complain to his engineer that he is using too much coal, or making too much smoke, or not keeping up steam, and asking for an explanation is told that the *bars* are in bad condition. They are *burnt through* and *falling out*, or they let the coal drop through, or the *clinker adheres* to them so fast that it takes all the stoker's time to clear his fires, and, of course, while doing so the cold air gets in at the door and reduces steam. All these reasons are very likely true, and although the stoker does his best and works hard, this state of things does not mend. The next day, perhaps, a traveller with a patent fire-bar waits on the owner, shows a nicely finished-model, and of a very *peculiar shape*, giving, as he says, more air space and guaranteed to save 20 per cent. of coal. The owner, so disgusted, perhaps, with the report of his engineer, like a sensible man orders a new set. They are put in. The flues are, perhaps, swept at the same time, or at least one or two barrow loads of dust are taken out of the flue at the back of the bridge. In the morning the fire is made, it burns splendidly and there is but little smoke, clinkers do not adhere, and as for steam, it blows off at the safety valve like a locomotive! The engineer quickly and truthfully reports most favourably of the bars, and the result possibly is, a testimonial goes to swell the large number already on the vendor's list. This is the mistake. So short a trial is no good; there is probably nothing sound in the principle of the bar, but some new-fangled shape or plausible argument induced the owner to give them a trial. While they are new and smooth there is a free passage for the air; clinker will not adhere; the flue having been cleansed of dust (than which there is no better non-conductor in existence) the boiler naturally steams better; but a month or two's time will bring about the previous state of matters, and most likely after trying one or two of these, the owner goes back as before to the old plain bar. There can be no doubt this illustrates the way in which many people are led to try a new fire-bar, and form a favourable opinion on insufficient trial or without sound scientific reason. It cannot be too clearly impressed upon steam users that the desiderata in a fire-bar include at least—1, Economical consumption of fuel, which includes reduction of smoke and saving of coal; 2, Durability; and 3, Non-adhesion of clinker.

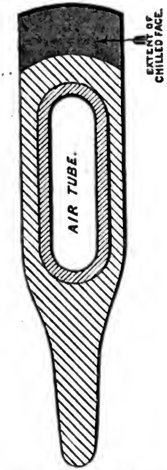


Fig. 1.—Section, full size.

How far the various generic forms of fire-bars that have hitherto been introduced fulfil these requirements may be matter of dispute, just according to which one of the several requirements may be esteemed most important in individual cases.

An improved bar of the tubular type, but possessing such features of novelty as entitle it to be considered unique and distinct from bars hitherto introduced, has recently come under our notice, and we are enabled to give illustrations of it (Figs. 1 and 2). This is the Patent Tubular Smoke-consuming Chilled-faced Fire-bar as manufactured by Messrs. Caddy & Co., of Nottingham, already extensively in use in land boilers, and now being largely adopted by steamship owners. From the sectional view of it (Fig. 2), it will be seen that an oblong tube of wrought iron extends throughout the bar. This distinguishing feature accomplishes two important purposes. It gives immense strength to the bar, and carries air to the back of the bridge, where, coming in contact with the unconsumed gases, it provides oxygen for their ignition. Smoke is thereby reduced to a minimum, and the greatest amount of heat is obtained from the coal. The breadth of the bar is only one inch, being less than most of the ordinary plain ones in general use. To increase its durability the best mixture of metal is used, and, being cast face down, that part which, when in use, is exposed to the heat of the fire is the heaviest and solidest metal, all scum and imperfections rising to the top or web of the bar. The face, which is slightly rounded, is also chilled to the depth of nearly three-quarters of an inch, and made so hard that in some cases it is years before it is touched by the fire. By the introduction of heated air at the back of the bridge, without robbing the grate of any air that ought to pass through it in the ordinary way, economical consumption of fuel is effected. By the smoothness of the chilled face and the temperature of the bar being reduced by the passage of air through it, clinkering is effectually prevented.

From what has been said—and the statements are vouched for by owners who have had eight months and more of practical experience of the bar—there seems little room for doubting that this type of bar possesses all the qualities necessary for the complete and economical combustion of fuel. Its lifetime is quite equal to that of three sets of ordinary bars, and that not alone because of the cooling influence of the air passage, but largely on account of the presence of the through wrought iron tube preventing warping, and even, in the case of fracture, preventing the bar dropping below the level of the grate, as a fractured or burnt bar of the ordinary kind would inevitably do.

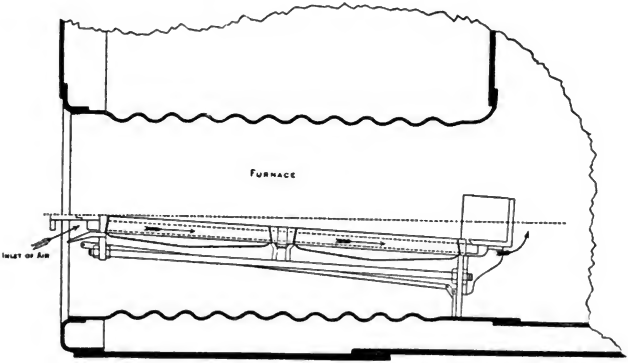


Fig. 2.—Arrangement for Marine Boilers.

Hero.—On Wednesday afternoon, July 30th, Messrs. Sir Raylton Dixon & Co. launched, from their Cleveland Dockyard, Middlesbro', a steel screw steamer to the order of the Bristol Steam Navigation Co., of Bristol. This vessel is built with raised quarter-deck, having accommodation under bridge for captain, officers, and engineers. Her leading dimensions are:—Length, over all, 208 ft. 9 in.; breadth, 30 ft.; depth, moulded, 14 ft. 3 in.; with a deadweight capacity of 950 tons. Her machinery will be fitted by Messrs. Blair & Co., Limited, of Stockton, on the triple-expansion principle, and having cylinders 16½ in., 27 in., and 44 in. by 30 in. stroke. On leaving the ways she was christened *Hero* by Mrs. Harvey, of Bristol.

WELSH NOTES.

TRADE at Cardiff is slowly recovering from the effects of the late railway strike, but there is scarcely any iron ore imported, as dock labourers refuse to accept the rate offered by the iron companies for the discharging of this material. Dock labour is still unsatisfactory, but the dockers have no funds to draw upon in the event of a strike, and as their wages are considerably above the average of other ports, it is very questionable whether they would receive any public sympathy in the event of a strike. The trade of the Bute Docks for July, as compared with the corresponding month of last year, was as follows:—Imports, 123,399 tons, against 143,737 tons; exports, 706,640 tons, against 724,423 tons. The trade of the Bute Docks for the week ending August 20 was as follows:—Coal, coke, and patent fuel shipments, 80,799 tons; imports, 15,546 tons. The arrivals were 44 steamers, of 26,556 tons register, and 54 sailing vessels, of 14,995 tons register. The vessels in dock were—43 steamers, of 56,288 tons register, and 136 sailing vessels, of 74,880 tons register. There has been a better demand for iron and steel during the month than for. several months past, and prices are firmer without exceptions Hematite pig-iron cannot be bought under 62s. for No. 3 Siemen. quality, forge numbers being 1s. 6d. per ton less, delivered c.f.i, South Wales ports. Steel tin-plate bars of both kinds—*i.e.* Bessemer and Siemens—have been largely sold, some makers having their order-books quite full. Buyers are quite prepared to pay the full "association" prices of £5 10s. and £5 17s. 6d. respectively, less 2½ per cent. delivered at consumers' works. The demand for tin-plates has lost some of the excitement of the previous week, but sellers are very firm, and decline business at less than 14s. 6d. to 15s. per box for common I.C. quality—14 by 20. For steam coal there was strong demand, the market closing firm at the following prices:—Best qualities, 14s. 6d. to 15s.; good dry coal, 13s. 9d. to 14s.; and small, 8s. 6d. to 9s. per ton. The house coal trade was quiet, No. 3 Rhondda was quoted at 13s. 6d. to 13s. 9d., No. 2 Rhondda 12s. 6d. to 12s. 9d., and through at 10s. 6d. to 11s. per ton. Owing to the activity in the iron and steel trades coke was again in good demand at 23s. for foundry, and 21s. for furnace. Pitwood prices were unaltered. In the outward freight market chartering was active, and a large number of fixtures were negotiated. The outward sail market was in a depressed condition, with very little offering for any direction.

Throughout the manufacturing counties of South Wales the staple trades are in a fairly prosperous state, and it is much to be regretted that progress should so frequently be interrupted by wages and other disputes, mainly in connection with the establishment of labour unions. Newport is the natural outlet for the products of a very large district by no means confined to Monmouthshire, and operations at this port are a sure indication of the state of things for many miles inland. For some time the docks have been full of tonnage, and increased quantities of coals, iron and steel rails, machinery, and various kinds of railway iron are being exported, while in patent fuel an improving business is being done. The imports also are increasing, and more especially in iron ore and mining timber, which are arriving in large quantities.

It was hardly to be anticipated that the trade of Swansea would in the past have maintained the high figures which were due in a measure to the strike at Cardiff and Barry, but a very satisfactory amount of business has been done. All branches of the export trade have been in excess of the average, but in sympathy with the general import trade of the kingdom, the imports continue below those of last year. There has been less excitement in the tinplate market during the month, but the market continues very firm and strong, and sellers are asking from 3d. to 6d. per box more money. In New York the market is active, and prices have gone up from 5c. to 10c. per box. The metal market is also more active; copper has been in good demand both here and on the Continent, and Chilli bars are from 20s. to 30s. higher. The imports for one week, that to the 20th of August, have amounted to 10,620 tons and exports to 44,503 tons—total trade, 55,123 tons, compared with 72,671 tons in the previous week, and 44,758 tons in the corresponding week of last year. The shipments of coal were 28,844 tons. The shipments of tinplate were 70,700 boxes, and receipts from works 67,922 boxes; stocks in dock warehouses and vans stand at about 156,661 boxes, compared with 153,939 boxes at the corresponding date of last year.

BELFAST TRADE NOTES.

THE shipbuilding yards in Ireland are gradually beginning to feel the approach of dull times, and although nearly all the berths have been well occupied up to the present, in some cases there is little prospect of anything coming to hand to take place of the vessels now on the stocks. The turn out for the last six months has been considerably below that of the corresponding period of last year. In the few cases where shipowners really intend to build they are evidently holding back their orders until there is a substantial reduction in both material and wages.

The general trade, however, is good, distilleries being very busy and doing increased business. Rope and twine works are doing a large foreign trade, and the Belfast Rope Works Co., Limited, are erecting some handsome new offices and have made a large addition to their premises to meet increased business. Engineering, tool making, and other trades are in a fairly good condition and show no signs of slackness.

LEITH NOTES.

AN interesting event in the shipping trade of Leith was witnessed on the 13th ult., when two vessels, sister ships, built to the order of Messrs. James Currie & Co., Leith, were launched within half-an-hour of each other. The steamers are about 1,150 deadweight capacity, and are named the *Nevada* and *Morena*, the *Nevada* being built by Messrs. Ramage & Ferguson and the other by Messrs. Morton & Co. They are intended to trade between Leith and the Baltic.

Messrs. Hawthorns & Co. have received an order for a small coasting steamer, 90 ft. in length, to be supplied by them with engines having cylinders 12 in. and 24 in. by 18 in. stroke.

A strike of riveters and platers occurred during the month at the shipbuilding yard at Kinghorn, and the masters remaining firm, large numbers of the men left for Dundee.

The Grangemouth Dockyard Co. have, during the month, launched a large barque to carry 2,500 tons, and have also sent off a fine awning deck steamer called the *Jose Romano*, built to the order of Messrs. Romano & Co., of Tobasco, Mexico. This enterprising firm are turning out a very large amount of good work, and their output for this year should compare favourably with that of last year.

RED CROSS.—On July 30th Messrs. J. L. Thompson & Sons launched at North Sands, Sunderland, a steel screw steamer of the following dimensions:—Length, 316 ft.; breadth, 40 ft. 6 in.; depth, 21 ft.; having a deadweight capacity of 4,200 tons, and built to the order of Messrs. Rowland & Marwood, Steamship Co., Limited, of Whitby. The vessel was named *Red Cross*.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Heligoland.—On July 31st there was launched at the Castle Moat Shipyard, Stockton-on-Tees, a steel (with iron exceptions) steamer of the following dimensions:—Length, 173 ft.; breadth, 26 ft.; depth, moulded, 12 ft. 11 in. She has been built for Messrs. Pile & Co., London, to class 100 A1 Lloyd's. She will be fitted by Mr. Middleton Pratt, of Huddersfield, with triple-expansion engines, having cylinders 13 in., 21 in., and 32 in. by 24 in. stroke. She was christened *Heligoland*.

Rockabill.—On July 31st Messrs. Sir Raylton Dixon & Co. launched from their No. 2 dockyard a steel screw steamer, which is the fourth vessel launched by her builders this month. She is a steel raised quarter-decked vessel, having a continuous bridge deck forming a partial awning-deck, web frames, cellular bottom, &c. Chief dimensions:—Length, over all, 307 ft.; breadth, 40 ft; depth, moulded, 21 ft. 4 in., with a deadweight capacity of 3,600 tons. Her engines will be fitted by Messrs. Blair & Co., Limited, Stockton, with cylinders 22 in., 36 in., and 59 in. by 39 in. On leaving the ways she was christened *Rockabill* by the Misses Maude and Edith Farrar, of Eccles (near Manchester), daughters of the senior partner of the firm of Farrar, Groves & Co. of London, the managing owners.

Hereford.—On August 1st Messrs. W. Dobson & Co. launched at Low Walker a steel screw steamer built to the order of the Great Western Steamship Co., Limited, of Bristol. This steamer is 310 ft. long, 40 ft. beam, and 22 ft. 9 in. deep, and has a carrying capacity of 3,900 tons. She will be fitted with engines by the Wallsend Slipway and Engineering Co., Limited. The vessel was named *Hereford*.

Wells City.—On August 2nd the steamer *Wells City* was launched at Bristol by C. Hill & Son, for their New York Line.

Screw Steamer.—On August 2nd Messrs. John Jones & Sons launched at Brunswick Dock, Liverpool, a screw steamer of 600 tons, for French owners. She has the highest class in Veritas, and will be fitted with triple-expansion engines.

Tynehead.—On August 2nd Messrs. Ropner & Son launched, at Stockton, a steel screw steamer, built to the order of Mr. Chr. Furness, of West Hartlepool, her dimensions being as follows:—Length over all, 282 ft. 6 in.; breadth, 38 ft. 10 in.; depth, moulded, 21 ft 11 in. She has been built to the highest class at Lloyd's, and is designed to carry 3,300 tons deadweight. She will be fitted with triple-expansion engines of 900 I.H.P. She was christened *Tynehead*.

Congo.—On August 2nd Messrs. Richardson, Duck & Co. launched from their building yard at South Stockton a steel screw steamer of the following dimensions:—Length, over all, 317 ft. 3 in.; breadth, extreme, 41 ft.; depth, in hold to tank top, 20 ft. 10 in. This vessel has been built for Messrs. Thomas Wilson, Sons & Co., Hull, under the personal superintendence of Mr. J. F. Wilkins, the owner's surveyor. She has a raised quarter-deck, and a long bridge joined to forecastle, also a double bottom on the cellular principle extending fore and aft for water ballast, &c. Her engines, by Messrs. Blair & Co., Limited, Stockton, are of triple-expansion type, with cylinders 22½ in., 37 in., and 61 in. by 42 in. stroke. As she was leaving the ways the vessel was christened *Congo* by Miss Richardson, of Potto Hall.

Tekoa.—On Saturday, August 2nd, Messrs. W. Gray & Co., Limited, launched a large steel screw steamer which has been built to the order of Mr. Christopher Furness, of this port, for the New Zealand Steamship Co., Limited, of London. The vessel will take Lloyd's highest class, and the dimensions are:—Length, over all, 376 ft. 6 in.; breadth, 47 ft.; depth, 29 ft. 4 in The deck erections consist of a poop, bridge, and forecastle. Two complete iron decks are laid, and inway of the holds the web-frame system of construction has been adopted, and a cellular double bottom is fitted throughout the ship for water ballast. The saloon, captain and officers' accommodation, &c., will be tastefully fitted up in the poop, the engineers' accommodation amidships, and the crew's berths forward. The arrangements for working the ship and handling cargo will be of the most efficient description, including patent direct steam windlass, steam stearing gear, six steam winches, &c. A considerable portion of the ship will be insulated for carrying frozen meat from New Zealand, and two powerful refrigerators will be fitted in the 'tween decks. Fine triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs.

W. Gray & Co., Limited. The cylinders are 27 in., 43 in. and 72 in. diameter, with a piston stroke of 45 in. The boilers are of the double-ended type, and are designed for a working pressure of 160 lbs. per square inch. The ceremony of naming the vessel *Tekoa* was gracefully performed by Mrs. McMullen, wife of Captain McMullen. The *Tekoa* is sister ship to the s.s. *Rangatira*, lately launched by Messrs. W. Gray & Co., Limited, and these are the largest vessels that have yet been built at the Hartlepools.

Enstalli Vlasopulo.—On August 6th there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Co., Limited, a steel screw steamer of the following dimensions:—Length between perpendiculars, 299 ft.; breadth, moulded, 40 ft.; depth, moulded, 22 ft. The vessel will be rigged as a two-masted schooner, and is built to class 100 A1 at Lloyd's. She is of the partial awning deck type, with a long raised quarter-deck aft. Accommodation for the captain, officers, and a few passengers is provided in the sunk poop aft, and for the engineers under the bridge amidships, while the crew and firemen are accommodated in the forecastle. All the decks are of iron, and a cellular bottom is provided right fore and aft. Clarke, Chapman & Co.'s direct acting steam windlass is fitted up forward, and Mnir & Caldwell's steam-steering gear amidships. The vessel has been built to the order of Messrs. E. D. Vlasopulo & Co., of Ibrail. She is of 3,700 tons burthen, was built under the superintendence of Captain Constantin Theophilatos, and when launched was christened the *Enstalli Vlasopulo* by Miss Innnlla Varmakiottes, of Tyne Dock.

Alpha.—On August 7th a twin-screw hopper barge was launched from the yard of the executors of the late Mr. T. A. Walker, at Sndbrook. She was named *Alpha*. The vessel is specially built for dredging purposes on the Manchester Ship Canal, and will be fitted with quadruple-expansion engines.

Sarah Jolliffe.—On August 14th there was launched from the shipbuilding yard of Messrs. Jno. Redhead & Sons, West Docks, South Shields, a handsomely-modelled screw steamer of the following dimensions, viz., 136 by 25½ by 14 ft. moulded. The vessel is built of steel, and has been specially designed and adapted for heavy oversea towages, also for passenger traffic on the Mersey. She will be fitted with triple-expansion engines working at a pressure of 160 lb., and having a registered N. H. P. of 250. The engines and boilers have also been built by Messrs. Readhead. The steamer, which is named the *Sarah Jolliffe*, has been built to the order of Messrs. W. & T. Jolliffe, of Liverpool, under the superintendence of their inspector, Mr. Thomas Grant.

Ville de Paris.—On August 16th Mr. James Laing launched the new steel steamship *Ville de Paris*, built to the order of the Campagnie Havraise Peninsulaire de Navigation a Vapeur, of Havre, being the eleventh steamer built for this firm for the same owners. Dimensions:—Length, 360 ft.; breadth, 42 ft.; depth, 29·6 ft. moulded; register tons about 3,500. On leaving the ways the vessel was named by Mdlle. Barry, of Newcastle.

Joseph Davis.—On August 16th Messrs. Short Bros. launched from their shipbuilding yard at Pallion a steel screw steamer, built to the order of Mr. James Westoll, Sunderland, and of the following dimensions:—Length, 290 ft.; breadth, 39 ft.; depth, moulded, 24 ft. 4 in. The vessel was named *Joseph Davis* by Mrs. Cameron, sister-in-law of the owner. The engines are triple-expansion, with 21½ in., 35 in., and 58 in. cylinders.

Ely.—On August 16th Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the last steamer they had on the stocks. The vessel is the second built this year for the Cardiff Steamship Co., managed by Messrs. Hooper, Campbell & Co., and is of the following dimensions:—200 ft. long; 29 ft. 3 in. broad; by 15 ft. 3 in. deep, with long full poop and top-gallant forecastle. Tri-compound engines by the North-Eastern Marine Engineering Co., Sunderland, will be fitted, and the vessel has all the usual appliances to enable it to be quickly loaded and discharged. The vessel was named the *Ely* by Miss Gladys Hooper.

Prins Willem 1st.—On August 16th Messrs Richardson, Duck & Co. launched from their building yard a finely-modelled steel screw steamer of the following dimensions, viz.:—Length, over all, 275 ft.; breadth, extreme, 36 ft. 3 in.; depth, moulded, 22 ft. 3 in.; tonnage, gross, about 1,700 tons. The vessel has been built to the order of the Koninklijke West Indische Maildienst, Amsterdam, and has been built under the superintendence of Mr. Fenenga, of that place, and will take the highest class at Lloyd's; Bureau Veritas and the Ned. Vereeniging registers. She has a full poop, extending to fore end of boiler space and top-gallant forecastle. The after-part of poop is elaborately fitted up for the accommodation of 28 first-class passengers, with handsome dining-saloon full width of ship. Fore-end of poop has accommodation for eight second-class passengers with saloon; also berths for officers, engineers, doctor, purser, stewards, &c. Top-gallant forecastle is fitted up for sailors, firemen, and petty officers, with permanent pens for live stock. On poop-deck are two large teak deckhouses; forward one containing steam steering gear, captain's room, and chart-house. After, one smoke-room, ladies' cabin, and companion to first-class accommodation. Three double-steam winches, large donkey boiler and steam windlass will be fitted. The vessel, which has extremely fine lines, is intended to attain a high rate rate of speed, and will be engined by Messrs. Thomas Richardson & Sons, Hartlepool. As she left the ways she was christened *Prins Willem 1st* by Baroness Tindal, of Amsterdam.

Fazilka.—On August 16th Messrs. Wm. Doxford & Sons launched from their yard at Pallion, a beautifully-modelled cargo steamer, built to the order of the British India Steam Navigation Co., Limited, of London, Glasgow, &c. This vessel is of steel with cellular bottom fore and aft, and teak upper deck and poop bridge and forecastle, to Lloyd's 100 A1 class. Her dimensions are:—Length, 380 ft.; breadth, 48 ft.; depth, 29 ft. 3 in. The engines are the ordinary triple-expansion three-crank, by Messrs. Doxford, the cylinders being 28 in., 46 in. and 74 in. by 51 in. stroke, supplied with high-pressure steam from three exceptionally large boilers, capable of driving the vessel 11 knots, loaded with 6,000 tons, on a remarkable light draft of 23½ ft. She is fitted for their East African trade and has eight steam winches, 7 in. by 12 in., by Welford Bros., of Pallion, specially adapted for quick discharge, driven by large donkey boiler of 80 lbs. pressure, supplied by the Tyne Boiler Works Co. Windlass and capstan on forecastle by the well known makers, Messrs. Emerson, Walker & Thompson Bros., of Gateshead. Steering gear by Messrs. Bow, McLachlan & Co., Paisley, and screw gear aft by Crawford & Son, of Sunderland. The vessel is also fitted with eight iron derrick cranes of Messrs. Doxford's special design, fitted on four iron derrick posts placed midway between the centre and the sides of the ship, giving short radius of derrick, and swinging cargo about 12 ft. clear over ship's side. The officers and engineers are accommodated on the port side of bridge, while on the starboard side there is accommodation for 12 first-class passengers, splendidly got up to the company's first-class style and with captain's room on top of bridge, with flying bridge over wheelhouse, on flying bridge with open front. Suitable accommodation is provided for crew under forecastle. She is designed under the superintendence of Commander Geo. Hodgkinson, R.N., and Jno. Clark, Esq., of the British India Co., and during construction has been superintended by Mr. Peter Barr. Her keel was laid on 12th May, so that she has been built in the short time of 3 months 4 days, and is intended to sail about 30th September. Messrs. Doxford's have also a duplicate vessel underway, which will be launched in about six weeks' time for the same owners, who are also the owners of the large ship *Golconda*, built by Messrs. Doxford's in 1888. As the vessel left the ways she was gracefully christened the *Fazilka*, by Miss Nora Doxford.

Ethelwalda.—On August 18th there was launched from the shipbuilding yard of Messrs. Jno. Readhead & Sons, West Docks, South Shields, a steel screw steamer of the following dimensions, viz.:—290 ft. by 40 ft. by 22 ft. 6 in., moulded. She is classed 100 A1 at Lloyd's, under special survey, is of the improved well-deck type, having poop aft, raised quarter-deck, long extended bridge and topgallant forecastle, and is fitted with shifting boards, &c., to meet requirements of Grain Cargoes Act. The vessel will be fitted with triple-expansion engines, also built by Messrs. Readhead, of 23 in., 37½ in., 61½ in., by 39 in. stroke, to work at a pressure of 160 lbs., steam being supplied by two large steel boilers. She has been built under the inspection of Mr. S. Walton, superintendent for the owner, J. H. Harrowing, Esq., of Whitby. As the vessel left the ways she was named the *Ethelwalda* by Miss Mary Barker, niece of the managing owner.

Capenor.—On Monday, August 18th, Messrs. Edward Withy & Co. launched from their yard at Hartlepool a large steel screw steamer built to the order of George Steel, Esq., West Hartlepool, for Messrs. Steel, Yonng & Co., of London. This is the

175th vessel in the builders' books, and the 33rd built in the Hartlepools for the same owners, 29 of these having been built by Messrs. Edward Withy & Co. She is a fine type of a modern cargo boat, measuring over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge house, and a top-gallant forecastle. The holds are fitted with iron grain divisions, and iron cargo battens; all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottoms, fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin, providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, and has been constructed under the personal supervision of George Steel, Esq. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the vessel was gracefully christened *Capenor* by Mrs. C. H. Foster.

Umhloti.—On August 19th Messrs. W. Gray & Co., Limited, launched a handsomely-modelled screw steamer of the following dimensions, viz.—Length, over all, 310 ft.; breadth, 40 ft.; and depth, 24 ft.; built to the order of Messrs. Bullard & King, of London, for their line of steamers between that port and Natal. The vessel takes Lloyd's highest class, is built of Siemens-Martin mild steel, and is of the spar-deck type, with short poop and long deck-house for passengers, having well-lighted berths, and the saloon tastefully finished with inlaid panels. The state-room will have patent fold-up washstands. The officers' rooms are amidships, and the crew's berths forward. A cellular double bottom is fitted throughout, and also peak tanks for water ballast. All the usual first-class working appliances will be provided, including patent stockless anchors stowing into hawse pipes, patent direct steam windlass, patent donkey boiler, two steam winches at each of the principal hatchways, double derricks, patent steam and hand steering gear amidships, screw gear aft, two pole masts with smart fore-and-aft rig, boats on beams overhead, &c. The Central Marine Engine Works of Messrs. W. Gray & Co., Limited, supply the engines, which are of the triple-expansion type of over 1,100 I.H.P., and two large steel boilers to work at 160 lbs. pressure per square inch. The hull and machinery have been built under the superintendence of Mr. J. Matthewson on behalf of the owners. The ceremony of christening the ship *Umhloti* was gracefully performed by Mrs. McMordie, daughter of Sir William Gray.

Sam Lancaster.—On August 20th Messrs. T. & W. Smith launched from their yard, North Shields, a screw steamer to the order of Messrs. Lancaster, Speer & Co., Cardiff and London. The following are the vessel's dimensions:—Length, 168 ft.; breadth, 25 ft.; depth, 13 ft. She will carry 750 tons deadweight on Lloyd's freeboard, and her hull and machinery are built to the requirements of class 100 A. The vessel will be fitted with modern appliances for securing rapid despatch. The engines will be supplied by Messrs. J. P. Rennoldson & Sons, South Shields, and will be of the triple-expansion type, with cylinders 13½ in., 22 in., 36 in. respectively, with 24 in. stroke. As the vessel left the ways she was named the *Sam Lancaster* by Mrs. H. Armstrong, of Bentwick Cresent, Newcastle.

Bushmills.—On Monday, August 25th, the large screw steamer *Bushmills* (called after the celebrated Irish whisky distillery), built by Messrs. Edwin Withy & Co., for Messrs. Boyd Bros. & Co., Limited, Belfast, proceeded on her trial trip in Hartlepool Bay. This vessel is a fine screw steamer built of Siemens-Martin steel and measures over 300 ft. in length. Special attention has been given to her design so that she can carry cargoes of the bulkiest description, and to strengthen the structure as much as possible nearly all the shell plates are in 24 ft. lengths, and the hold fittings and deck erections are principally of iron. She has cellular bottoms throughout, and for the handy working of vessel and cargo she is fitted with four steam winches, stockless anchors hauling up into hawse pipes, steam windlass, steam steering gear, and all the latest provements. The saloon and cabin providing accommodation for the passengers, captain and officers, is handsomely finished in polished hardwood with painted panels executed in an effective style by the staff of ladies employed by the firm. The engines are by the well-known firm of the Central Marine Engineering Co., Limited, West Hartlepool, and embody all the latest improvements. Their working gave every satisfaction to the owner's representatives. The vessel has been built under the personal superintendence of Captain Brady. After the trial of ship and machinery, the visitors were landed and the vessel proceeded to London to load for America.

LAUNCHES.—Scotch.

Albardon.—On July 16th there was launched from the shipyard of D. M. Cumming, Blackhill Dock, Glasgow, an iron and steel twin-screw launch, named *Albardon*, for passenger and towing purposes at Rio de Janeiro. Dimensions: 62 ft. 6 in. by 13 ft 6 in., by 6 ft. 3 in., moulded; her engines, which are compound surface-condensing, indicating 130 H.P., being supplied by Messrs. Kincaird & Co., Greenock.

William Flower.—On July 29th Messrs. David J. Dunlop & Co., Inch Works, Port-Glasgow, launched from their shipbuilding yard a steel screw tug of the following dimensions and particulars:—Length, between perpendiculars, 65 ft.; breadth, moulded, 14 ft.; depth, moulded, 8 ft. 6 in.; tonnage, gross, 50 tons. This vessel has been built to the order of Messrs. Flower & Everett, of London, and is intended for their service in the River Thames, having been constructed to class in Lloyd's register A "steel tug," for River Thames, specially strengthened for the class of work she has to perform. The steamer, which was named the *William Flower*, will be fitted by her builders with compound surface condensing engines of about 200 H.P.

Burnock.—On July 29th Messrs. S. M'Knight & Co., shipbuilders, Ayr, launched from their yard a steel screw steamer, built under special survey to class 100 A1 in Lloyd's registry to the order of the Garnock Steamship Co., Limited, Messrs. Rowan & Bain, Ayr, managers. Dimensions:—Length, b.p., 160 ft.; breadth, 25 ft.; depth of hold, 12 ft.; 440 tons gross. The engines are triple-expansion, and will be supplied by Wm. Kemp, Govan; cylinders, 14 in., 22½ in., 36 in. by 27 in. stroke. The vessel, which is named *Burnock*, is the second steamer Messrs. M'Knight have built for this company. The first steamer, the *Garnock*, ran her official trial on Saturday, when she attained a speed of 10½ knots, loaded with 560 tons deadweight.

Imogen.—On July 31st Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched a finely-modelled steel steam yacht, 184 ft. by 24 ft. by 15½ ft., of 410 tons, yacht measurement. This vessel has been built to the order of Mr. F. R. Wood, and is fitted up in a luxurious and handsome manner, with all the latest improvements, including electric light, &c. Her accommodation consists of dining-room, smoking-room, drawing-room, state-room, and music-room, all furnished and upholstered in first class-style. Her engines are to be of the builders' patent quadruple-expansion type to indicate 1,000 H.P., which it is expected will drive her 13 knots. As she left the ways she was named the *Imogen* by Mrs. W. Y. Fleming, Castlehead, Paisley.

Vadala.—On August 1st Messrs. William Denny & Bros. launched at Dumbarton the s.s. *Vadala*, of about 3,000 tons gross register, for the British India Steam Navigation Co.'s cargo and passenger service. She will be fitted with quadruple-expansion engines.

Dundee.—On August 2nd there was launched from Abden Shipbuilding Yard, Kinghorn, a steel screw passenger and cargo steamer, named *Dundee* by Mrs. Captain Turnbull. Length, 230 ft. by 29 ft. by 16 ft., with full poop bridge-house and t.g. forecastle. She has handsomely fitted accommodation for fifty first-class passengers in the poop and a large number of second-class passengers under the forecastle deck. She has three steam cranes, three steam winches, and all modern improvements for rapid handling of cargo. The engines are triple with cylinders 19½ in., 32 in. and 53 in. by 42 in. stroke. Steam is supplied by two boilers of the usual type, for 165 lbs. working pressure. The engines are fitted with Weir's feed heater and pumps. She was launched with steam up and went out for a trial trip on Wednesday, August 6th, everything working satisfactorily, speed of about 13 knots being attained.

A Dredger.—On August 2nd Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched into the river Mersey, a powerful steam dredger, capable of lifting 400 tons per hour from a depth of 26 ft. This dredger has been built to the order of Mr. T. A. Walker, contractor for the Manchester Ship Canal, and is intended, in the first place, for deepening the Mersey at Warburton, where the canal takes, for some distance, the present course of the Mersey. As at present there are no means of floating her to where she is required to work, the builders shipped this dredger in pieces, and erected her in the Latchford section of the canal, where she was launched into the Mersey, and from this point she will cut her way into the canal proper, and be there used for dredging out same.

Myrmidon.—On August 4th Messrs. Scott & Co., Greenock, launched a steel screw steamer for the Ocean Steamship Co., Liverpool. Dimensions—336 in. by 38 ft. by 26 ft., and 2,960 tons gross. She was named the *Myrmidon*, by Mrs. Alf. Holt, Liverpool. The builders will supply compound tandem engines of 1,500 I.H.P., the cylinders 26½ in. and 62 in. respectively, with a piston stroke of 5 ft. The *Myrmidon* is a sister steamer to the *Priam* and *Teucer*, and the *Polyphemus* is to follow.

Innamincka.—On August 4th Messrs. Napier, Shanks & Bell launched the steel screw steamer *Innamincka*, built to the order of Messrs. Elder, Smith & Co., London, on behalf of the Adelaide Steamship Co., Port-Adelaide, Australia, and constructed under supervision of Captain Joseph Hay. The *Innamincka* is a two-decked vessel, with web-frames in lieu of lower deck, a double cellular bottom, long full poop, and top-gallant forecastle. Her dimensions are—305 ft. by 40 ft. by 22 ft. 8 in.; tonnage, about 2,600 tons. Class 100 A1 at Lloyd's; schooner rig; accommodation of a superior description for a large number of first-class and second-class passengers.

Lanark.—On August 4th this vessel, built to the order of G. M. Steeves, Esq., of Liverpool, by Messrs. Russel & Co., was successfully launched from their Greenock yard. Her principal dimensions are:—Length, 323 ft.; breadth, 42 ft.; depth, 23 ft. 6 in., and she will carry 4,700 tons deadweight. She will be fitted by Messrs. Dunsmuir & Jackson, of Govan, with engines of the triple-expansion type, having cylinders 24 in., 37 in., and 64 in. diameter, with a stroke of 45 in., supplied with steam by two extra large double-ended steel boilers, also by Messrs. Dunsmuir. The construction of the vessel's machinery and boilers has been superintended by Messrs. Flannery & Blakiston, of Liverpool and London.

Snaigow.—On August 4th Messrs. Russell & Co., launched from their Kingston yard, Port-Glasgow, the large four-masted steel barque *Snaigow*, for Messrs. David Bruce & Co., of Dundee. She is a sister ship to the *Holt Hill*, recently built by Messrs. Russell & Co. for Messrs. Price & Co., of Liverpool. On launching the *Snaigow* was gracefully named by Miss Cox, daughter of Mr. Wm. Cox, of Snaigow. The *Snaigow* is 283·0 by 43·0 by 24·3, and will carry about 3,800 tons deadweight. She is fitted with donkey boiler and two steam winches for the rapid handling of cargo, and the pumps and windlass are driven by steam. After masting she will proceed to James Watt Dock to load for Rio de Janeiro. The *Snaigow* was superintended during construction by Mr. George Todd, marine surveyor, and she will be commanded by Captain Walker, late of ship *Maulesden*, who has been in the service of Messrs. Bruce & Co. for a number of years.

Doune Castle.—On August 4th Messrs. Barclay, Curle & Co., Limited, launched from their yard at Whiteinch a steel screw-steamer for the Castle Line Mail Packet Co. of Messrs. Donald Currie & Co The new vessel, which is named the *Doune Castle*, has been built to Lloyd's highest class under special survey, and to suit the Admiralty requirements for transport service. The principal dimensions are:—Length, 410 ft.; breadth, 43·3 ft.; depth, 31 ft; and she has a tonnage of 4,000 gross. The vessel, which is for the Castle Line Royal Mail Service to South Africa and Cape Colony, has accommodation for 31 first-class passengers in a bridge-house forward of the engines; 42 second-class passengers aft; and 80 third-class passengers on the after 'tween decks. Arrangements have also been made for accommodating about 400 steerage passengers on the main deck if necessary. She will be propelled by triple-expansion engines supplied by the builders, the cylinders being 29½ by 48 by 78, stroke 4 ft. 6 in., to develop 3,500 H.P. The vessel will be fitted throughout with electric light by Messrs. Siemens Bros. & Co., Limited, London, and she will have a refrigerating chamber and engine by Messrs. Johnston, Gregson & Curry, and steam heating appliances by Messrs. John Phillips & Co., of Glasgow. The arrangements for working cargo are of the most complete and improved description. Placed on the upper deck are six of Messrs. Muir & Caldwell's steam winches and derricks, capable of lifting 20 tons weight, Messrs. Muir & Caldwell's steam steering gear, and Napier's patent steam windlass and capstan have been fitted forward. A specialty has been made of the lifeboats, which have been fitted by the builders with Messrs. Andrews & Mill's patent lowering apparatus During construction the vessel has been superintended by Messrs. List, Scott & Munn for the owners. The *Doune Castle* is the eleventh vessel built by Messrs. Barclay, Curle & Co., Limited, for the same owners, and they have a sister ship, to be named the *Lismore Castle*, at present on the stocks, also for the same owners.

Minerva.—On August 5th a six-rating cutter named the *Minerva* was successfully launched from the yard of Messrs. W. Fife & Son, Fairlie. She is built for Mr. Wm. Gouchareff, and is to go to Odessa.

Morena.—On August 12th Messrs. Morton & Co. launched at Leith a steel screw steamer named the *Morena*, for Messrs. Currie & Co. She is for the Continental trade, and is a sister ship to the *Nevada*.

Stubbenhuk.—On August 13th Messrs. Charles Connell & Co. launched at Scotstoun the steel screw steamer *Stubbenhuk*, of about 2,900 tons, for the Hansa Line of Hamburg. Her machinery is being fitted by Messrs. David Rowan & Son.

Nevada.—On August 13th there was launched from Messrs. Ramage & Ferguson's shipyard at Leith a steel screw steamer named the *Nevada*, built to the order of Messrs. James Currie & Co., Leith, for their Baltic trade. The principal dimensions being 230 ft. by 34 ft., by 20 ft. 9 in. to awning deck; deadweight about 1,150 tons. The engines, which are also supplied by the builders, are triple-expansion with cylinders 17 in., 27 in., and 44 in. by 30 in. stroke. W.P. 160 lbs., supplied with steam from large single-ended steam boiler. The *Nevada* on leaving the ways was named by Miss Walker, Kirkhill, Gorebridge.

Benlomond.—On August 14th Messrs. Alexander Stephen & Sons launched from their shipbuilding and engineering works, at Linthouse, a beautifully-modelled steel screw steamer, being the fourth vessel built by this firm to the order of Messrs. William Thomson & Co., Leith, for their "Ben" line of China traders. The vessel is built to class 100 A1 at Lloyd's, special survey, on the three-deck rule, conforming also with the Board of Trade requirements for passenger steamers, and is of the following dimensions:—Length, between perpendiculars, 310 ft.; breadth, extreme, 40 ft.; depth, moulded, 26 ft. 9 in. Like all the recent vessels of this line she has the now uncommon but graceful clipper bow, surmounted with a handsomely-carved figurehead and trail-boards, giving the vessel a yacht-like appearance in the water. The deck erections consist of a full poop, bridge, deck, enclosing engine and boiler casings and top-gallant forecastle. The saloon cabins, and captain's room, which are situated in fore part of bridge, are fitted up in a substantial and comfortable manner. At after-end of this erection handsome and airy cabins have been provided for the officers and engineers, while the crew are located in the top-gallant forecastle. The vessel has been constructed with a double bottom on the cellular principle for water ballast, has five steam winches, steam steering gear, steam windlass, and all the most approved appliances for the rapid and efficient handling of ship and cargo, and will be rigged as a two-masted schooner with square sails on foremast. Her engines, which were fitted on board before launching, are of the most improved triple-expansion type, having cylinders 24 in., 39 in., and 64 in. diameter respectively, with a piston stroke of 42 in., steam being supplied by two extra large steel boilers at 160 lbs. pressure. As the vessel left the ways she was gracefully named the *Benlomond* by the wife of Captain A. W. S. Thomson, late of the s.s. *Benvenue*, belonging to the owners, and who is to take command of the *Benlomond*.

Olivine.—On August 15th Messrs. Scott & Co., Bowling, launched from their shipbuilding yard a screw steamer of the following dimensions—Length, 165 ft.; breadth, 26 ft.; depth, 12 ft. 2 in.; built to the order of Mr. William Robertson, 15, Gordon Street, Glasgow, and intended for his general coasting trade. Triple-expansion engines will be supplied by Messrs. Muir & Houston, Portman Street, Glasgow. The vessel was named *Olivine* by Miss Martha W. Houston, Kilmalcolm.

Orion.—On August 16th Messrs. J. & J. Hay, shipowners, launched from their boatbuilding yard on the Forth and Clyde Canal the largest vessel ever launched on the canal. It was a steam lighter for their coasting trade, tonnage, 110 tons, length, 66 ft., breadth, 18 ft., and depth 9 ft. As it left the ways Miss Anne Robertson Cameron (daughter of ex-Provost Cameron, Southbank House, Kirkintilloch), gracefully named the vessel *Orion.*

Orbis.—On August 18th the Grangemouth Dockyard Co. launched a handsomely-modelled steel barque of about 1,500 tons register, to carry 2,500 tons deadweight on 19 ft. draught. On taking the water she was gracefully named the *Orbis* by Miss Jeanie Miller, daughter of one of the builders. The *Orbis* has been built to the order of Messrs. Albert, Evers & Classen, of Hamburg. The Dockyard Co. has a sister ship on the stocks at their Alloa yard also for Hamburg account, and which will be ready for launching in a fortnight. The *Orbis* will be commanded by Captain Olsen, who has superintended the construction.

Pass of Brander.—On August 19th Messrs. Robert Duncan & Co. launched from their shipbuilding yard at Port-Glasgow a large four-masted steel sailing ship of the following dimensions —Length, 270 ft.; breadth, 42 ft.; depth, 26 ft.; and of 2,000 tons net register, carrying 3,500 tons. This vessel has been built to the order of Messrs. Gibson & Clark, of Glasgow. After fitting out, she will load in Glasgow for San Francisco.

Satellite.—On August 20th Messrs. Blackwood & Gordon, Port-Glasgow, launched a steel twin-screw steamer of 1,400 tons register, named *Satellite.* The dimensions are:—Length, 260 ft.; breadth, 34 ft.; depth, 19 ft. 8 in., moulded. This vessel is specially constructed to carry a large deadweight cargo on a light draught. She will be fitted with two sets of triple-expansion engines by her builders.

Culmore.—On August 20th Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a three-masted steel sailing ship named *Culmore,* to the order of Messrs. Thomson, Dickie & Co., Glasgow. Dimensions:—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft. She is 1,700 tons net register, and will carry 2,800 tons cargo on Lloyd's freeboard. This vessel is sister ship to the *Templemore* and *Edenballymore,* built some months ago by Messrs. Russell & Co. for the same owners. She will fit out at Port-Glasgow, and will be commanded by Captain Reid.

Iron King.—On August 21st there was launched from the yard of the Ailsa Shipbuilding Co., Troon, a steel screw steamer, 160 ft. by 26 ft. by 11 ft. 9 in. moulded, built to the order of Messrs. Thomas M'Laren & Co., Glasgow, under the superintendence of Mr. Ludovic Blackwood, for Mr. Henry Howie, of Whitehaven, for coasting trade. The engines, which are being supplied by Messrs. Muir & Houston, Glasgow, are triple-expansion, cylinders 14 in., 23 in., and 36 in. by 27 in. stroke. The vessel as she left the ways was gracefully named *Iron King* by Mrs. Thomas M'Laren, Coila Lodge, Prestwick.

LAUNCHES—IRISH.

City of Perth.—On July 23rd there was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Belfast, this large steel screw steamer, for Messrs. George Smith & Sons, Glasgow. The principal dimensions of the vessel are:—Length, 361 ft. 7 in.; breadth, 42 ft. 6 in.; depth, 29 ft. 4 in.; the gross tonnage being about 3,430. The vessel is of the three-decked type, having two steel decks, the upper being sheathed with teak, and will be engaged principally in the cargo trade, but has accommodation for passengers. The engines are of the triple-expansion type; the boilers are to supply steam at a high-pressure, and are provided with forced draught. The machinery has been constructed by Messrs. J. & J. Thomson, Finnieston Engine Works, Glasgow.

Ethelwold.—On August 14th there was launched by Messrs. Workman, Clark & Co. at Belfast, a steel screw steamer named the *Ethelwold.* She has been built for the Macgregor Steamship Co., Limited, the managing owners of which are Messrs. Colvils, Lowden & Co., Glasgow. Her dimensions are:—Length, 208 ft.; breadth, 28 ft.; depth, 18 ft.

Gregorian.—On August 16th there was launched by Messrs. Harle [illegible] olff, Belfast, the screw steamship *Gregorian,* for the Le [illegible] Frederick Leyland & Co., Liverpool. She is [illegible], beam, 31½ ft. depth, and will carry 7,000 tons deadweight. She is reported to be the largest carrying vessel afloat; will be fitted up with all the latest improvements for North Atlantic trade, and will have accommodation for about 1,000 cattle. She has a special hold for dead meat.

Parkmore.—On August 16th a large steel screw steamer named the *Parkmore* was launched from the Foyle shipyard. She has been built by Mr. Charles J. Bigger to the order of Messrs. Wm. Johnston & Co., Limited, Liverpool, and her dimensions are as follows:—Length, between perpendiculars, 340 ft.; breadth, moulded, 42 ft. 4 in.; depth of hold, 23 ft. 3 in.; gross tonnage, 3,500 tons; deadweight capacity, 5,000 tons on a mean draft of 24 ft. As the *Parkmore* left the ways she was gracefully christened by Mrs. Baxter, wife of the Mayor of 'Derry. The vessel is built in excess of Lloyd's highest class, and has been specially constructed for the North Atlantic cattle trade between Liverpool and Boston and Baltimore, accommodation being provided for about 1,000 head. There are seven watertight bulkheads, and a double bottom in after hold for 130 tons of water ballast. A deep tank forward of the engine-room is also fitted, capable of holding 580 tons of water. Every modern improvement is adopted for the rapid discharge of cargo, five steam winches with double derricks to each being provided. Amidships the *Parkmore* is fitted up in an elegant manner for the accommodation of the captain and officers, the firemen and crew having their quarters under the forecastle decks, and the cattlemen under the poop. Immediately after the launch the *Parkmore* was placed under the 60-ton steam crane, where she received her masts.

TRIAL TRIPS.

Breidablik.—On July 2nd the new steamer *Breidablik,* built at the Bergen Engineering Co., Norway, had a most satisfactory trial trip. She is built for Mr. Joh. C. Gjertsen, and is to some extent intended for the Transatlantic trade. The principal dimensions are:—Greatest length, 201 ft.; breadth, 28 ft.; depth, moulded, 13¾ ft.; depth in hold, 13 ft.; carrying capacity, about 910 tons, inclusive of bunkers, on a draught of 13 ft. The engines are on the triple-expansion principle, with cylinders 15½ in., 25 in., and 40 in. in diameter by 27 in. stroke. The boiler is of steel, designed for a working pressure of 180 lbs. per square inch. At the trial trip the engine indicated 540 H.P., wth 97 revolutions, and gave the steamer a speed of about 11 knots, with the water tanks filled.

Lizzie.—On July 18th the screw steamer *Lizzie,* a vessel 283 ft. 6 in. by 38 ft. by 20 ft. 3 in., built by Messrs. Joseph L. Thompson & Sons, Sunderland, for Mr. James Gray, Whitby, left Sunderland for her trial trip. Her engines, which have been supplied by Messrs. Blair & Co., of Stockton, were of the triple-expansion type, and her trip was in every way satisfactory.

Voltaire.—On July 23rd this new steel screw steamer, recently launched from the Alloa yard of the Grangemouth Dockyard Co., went down the Firth of Forth on her official trial trip. On the measured mile a speed of 10 knots was attained, which was in excess of the guaranteed speed.

Lavinia.—On July 24th the s.s. *Lavinia,* launched in the beginning of last month by the Ailsa Shipbuilding Co., at Troon, ran a fully-loaded trial on the measured mile at Skelmorlie, and attained a speed of 10½ knots per hour. This vessel is 142 ft. by 25 ft. 6 in. by 12 ft. 11 in., and is the third of similar dimensions built by the Ailsa Shipbuilding Co. for Captain John Weatherill, of Messrs. Mackenzie & Co., of Dublin. She is built of steel to Lloyd's highest class, and is fitted up with steam steering gear and steam windlass, and will be employed in conveying coals from the English and Scotch ports to Dublin. She is fitted with triple-expansion engines having 14 in., 22¼ in., and 36 in. cylinders by 27 in. stroke, by Mr. William Kemp, of Govan.

Steam Launch.—On Friday, July 25th, Messrs. [illegible] Forrestt & Son, of The Shipyard, Wyvenhoe, Essex, and Norway Yard, Limehouse, London, E., ran on the River Colne a trial trip of a steam launch for service on the Upper Congo. Her dimensions are 53 ft. over all; 50 ft. between perpendiculars; by 9 ft. 3 in. by 3 ft. draft of water; with 6 tons, only 18 [illegible]. The hull is constructed of mild galvanised steel, fitted with [illegible] cargo hatches forward and aft, and with a cabin at the after end for the accommodation of Europeans. The engines [illegible] of the com- [illegible]ed.

pound high-pressure type, with a vertical boiler. The hull and machinery are designed as lightly as possible for transport from the coast to Stanley Pool, and only a few parts weigh over 60 lbs. each. The boiler was bolted together for the purpose of the trial. After a run of three hours, on which a speed of nine miles an hour was obtained, the launch returned to the builder's yard, where she was immediately placed on their patent slip, there to be taken to pieces and packed. A sister boat is almost completed for the same service.

Corea.—On July 26th the new steel well-deck cargo steamer *Corea*, built at Blyth by the Blyth Shipbuilding Co., Limited, for Messrs. Stephens, Mawson, & Goss, of Newport, Mon., had her official trial trip, when the owners, engineers, and shipbuilders, and a large party of friends were on board. The vessel left the company's yard in the morning, under the command of Captain Irvine, and successfully ran the measured mile, giving results which were highly satisfactory to all interested. The party sat down to an excellent lunch, when the usual toasts were honoured. The builders of the vessel and the engineers were highly complimented on the excellent character of the whole of the work, which has been carried out under the superintendence of Mr. Landreth, the owners' representative. The *Corea* is a duplicate of the *Crimea*, recently completed for the same firm, and is built on the web-frame principle; has water ballast in cellular bottom, and is fitted with all appliances for the quick and complete working of the vessel. Laidman's patent hatch cover fastening is also fitted, and was much praised.

Etona.—On July 31st this screw steamer, 296 ft. 9 in. by 40 ft. by 21 ft., built by Messrs. Duck & Co., Stockton, for Messrs. Bucknall & Son, London, left the Tees for her trial trip. Her engines are of the triple-expansion type, built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working satisfactorily, the vessel attaining a speed of about 11 knots.

Frederica.—About the end of July this vessel, the first of three ships designed and built by Messrs. James and George Thomson, Limited, to the order of the London and South-Western Railway Co., and intended for passenger and cargo service between Southampton and the Channel Islands, completed a series of official trips at Stokes Bay before being handed over to the South-Western Co. The preliminary specification for these ships was for a steamer shorter and only slightly faster than the *Lynx*, *Antelope*, and *Gazelle*, of the Great Western Co.; but on the advice of the builders the length and other dimensions were increased, with the result that they were enabled to guarantee a considerably better speed. The *Frederica* is now the fastest vessel running to the Channel Islands by about 1½ knots. Her dimensions are—Length, 260 ft.; breadth, 35 ft.; depth to main deck, 15 ft. 8 in.; gross tonnage, 1,060 tons. An important feature in the design of the *Frederica* is the adoption of twin screws, the older vessels of the fleet being either single screws or paddle boats. This departure has been justified by the result, as the anticipated speed has been more than attained, and the engines have worked without a hitch both on the extended official trials and on the trip from the Clyde to Southampton. In six runs on the first day over the measured mile in Stokes Bay, with open stokeholds, a mean speed of 18·7 knots was attained—a rate which was afterwards maintained during a run of several hours. On the second day a similar set of six runs was made with a moderate air-pressure in the stokeholds. The mean speed attained was 19·5 knots, which was also kept up during a continuous run. The *Frederica* is of the type known as quarter-decked. The first-class saloon and sleeping cabins are situated aft of the machinery space, below the quarter-deck. The saloon is handsomely furnished, chiefly in mahogany, relieved by decorative panels, and has dining accommodation for 46 passengers. The total first-class sleeping accommodation is for 140 passengers. The ladies' sleeping saloon is an airy and handsome apartment, situated in a large deckhouse above the quarter-deck. There are also six large private cabins provided on deck, with separate lavatory accommodation. The accommodation for second-class passengers is situated forward of the machinery space, comfortable sleeping accommodation being provided for 70 passengers. The *Frederica* is divided into eight compartments, by means of watertight bulkheads. The compartments are effectively ventilated by a carefully-devised system, by which the vitiated air is exhausted from each living space by steam fans, and fresh air supplied in its place. The vessel is lighted throughout by electricity, this being the first installation which has been made by the new electrical department of the Clydebank Co. The *Lydia* and *Stella*, sister ships to the *Frederica*, will be ready for their trials in the course of a few weeks.

Stanley.—On August 2nd Messrs. Cochrane, Cooper, & Schofield launched at Grovehill a steam trawler which they have built for Mr. Waddington, of Boston. The vessel, which was named the *Stanley*, is of the following dimensions:—Length, 100 ft.; breadth, 25 ft. 6 in.; depth, 11 ft. She will be fitted with 45-H.P. triple-expansion engines by Messrs. C. D. Holmes & Co., of Hull.

Manchester.—On August 2nd the new hopper dredger *Manchester*, recently launched from the yard of Messrs. William Simons & Co., Renfrew, had her dredging and steaming trials on the Clyde with results in every way satisfactory alike to the owner and builders, everything working without a hitch, and with perfect smoothness. The *Manchester* has a capacity in its own hopper for 900 tons of dredgings, and when tried off Greenock dredging clay she loaded at the rate of 1,000 tons per hour; afterwards she proceeded to Wemyss Bay, where the measured mile was run at the rate of nine knots an hour. The trials were witnessed by Mr. S. R. Platt, one of the directors of the Manchester Ship Canal Co; Mr. James Deas, C.E., Clyde Navigation; Mr. Robert Crawford, harbour engineer, Greenock; ex-Provost Wilson, Greenock; Messrs. Edwards & Robson, Lloyd's surveyors; and Mr. Robert Anderson, Renfrew; also by Messrs. J. P. de Winton, and E. G. Carey, A.M.Inst C.E., acting on behalf of the Manchester Ship Canal Co., for whom the dredger has been built, under the direction of the company's engineer, Mr. E. Leader Williams, M.Inst.C.E. The *Manchester* left the Clyde for the Mersey, to commence work at entrance to the new canal.

Hygeia.—On August 2nd the new magnificent saloon steamer *Hygeia*, built by Messrs. Napier, Shanks & Bell, Yoker, and engined by Messrs. Rankin & Blackmore, Greenock, to the order of Messrs. Huddart, Parker & Co., of Melbourne, Victoria, went out for her official trial of speed. The *Hygeia* has been specially designed for passenger service on Port Philip Bay. Her hull is modelled with a view to a high rate of speed on light draught, while the general arrangements resemble those of the Clyde passenger steamers, with special modifications and improvements to suit the intended traffic. Her dimensions are:—300 ft. by 32 ft. by 12 ft.; tonnage, 978 tons gross. The accommodation on her three decks is so arranged that she can carry without being crowded about 1,300 passengers. The internal arrangements are of the most complete and elaborate description. The dining saloon, in which considerably over 100 could sit down to dine with comfort, is situated aft, under main deck, and is fitted up in a luxurious style. The sofas and settees are upholstered in Utrecht velvet, and the floor is laid with Brussels carpet and runners. This, and the whole of the upholstery work throughout the vessel, being the work of Messrs. J. G. Rowan & Co., of Glasgow and Greenock. The general saloon, which extends the full width of the vessel, is situated immediately above dining saloon, the woodwork and upholstery being of the finest description. Forward on main deck is a handsome smoking saloon and bar fitted out with all the latest improvements for the convenience of passengers, while immediately underneath is fitted out in hardwood another dining saloon. In the wing houses are rooms for captain, chief engineer, lavatories, barber's shop, bakery and scullery, &c. The promenade deck, which is carried to the sides, extends nearly the whole length of the vessel. It is approached from the main deck by three spacious and easy stairs, with handsome balusters and rails. The *Hygeia* has been fitted throughout with electric light by Messrs. Paterson & Cooper. The steam-steering gear has been supplied by Messrs. John Hastie & Co., the steam cable capstan by Clarke, Chapman, and the steam warping capstan aft by Napier Bros. Besides the telegraphs from the flying bridge to the engine-room, there are telegraphs to the mooring bollards forward and aft for convenience in mooring the vessel. The ventilation of the ship is very complete, six large trunk ventilators being placed over the saloons, extending above the permanent awning over the promenade deck. The engines of the *Hygeia*, which are of the diagonal tandem triple-expansion type of 400 N.H.P., have been constructed on Rankin's patent 4-cylinder disconnective principle, and they appear to be particularly well suited for swift river steamers on account of their simplicity and smooth working, combined with greater economy of fuel and upkeep. The cylinders are 28 in., 28 in., 56 in., and 86 in. in diameter respectively, by 66 in stroke of piston; and they are coupled to a double throw-crank shaft by means of a massive pair of connecting rods, which, as well as the main bearing seats, are fitted with heavy bushes of phosphor bronze. The most modern improvements have been incorporated in the machinery department, including Brown's patent reversing gear for actuating the main engines, Drysdale's disconnective engines and pumps for circulating the condensing water, Carruthers's duplex donkey pumps for feeding the boilers, &c.; Alley & MacLellan's Westinghouse engines and fans have been utilized for maintaining a pressure of 140 lbs. in the six large "Navy" boilers, which have been employed in this case (owing to their former repeated successful adoption) in combination with forced draught on the closed stokehole principle, on account of the considerable saving of weight thus affected as compared with the ordinary marine boilers and natural draught. For the effective preservation of the boilers one of Kirkcaldy's feed-heaters has been provided. The working of the engines is regulated from the flying bridge, where three of Chadburn's patent duplex telegraphs are placed in close proximity to the two docking telegraphs. Between the Cloch and Cumbrae lights the *Hygeia* maintained an average speed of 22¾ miles per hour, the highest speed reached being 23½ miles. The engines worked steadily at full pressure, ample steam being kept up without difficulty throughout the runs. The *Hygeia* has been built to outstrip the *Ozone*, which the same builders and engineers sent to Australia four years ago. The owners were represented by Captain Webb and Mr. Robt. Morton (of Morton & Williamson), under whose superintendence the vessel has been built.

Westward Ho.—On August 4th the new screw trawler *Westward Ho* run her trial trip off the Tyne, and after several runs over the measured mile excellent results were attained, making an average speed of 10¼ knots. This vessel has been built to the order of Messrs. J. Sanderson and Partners, by Messrs. J. T. Eltringham and Co., South Shields, and engined by Messrs. Baird & Barnsley, North Shields. She is especially adapted for deep-sea fishing, having extra large bunker space, fitted with all the latest requirements, adapting her for fishing and fish carrying. The dimensions are 100 ft. over all; 18 ft. 6 in beam; 10 ft. 8 in. depth; engines, 16 in. by 32 in. by 22 in. stroke.

Brilliant.—On August 6th the steel tank steamer *Brilliant*, recently launched from the Walker shipyard of Messrs. Sir W. G. Armstrong, Mitchell & Co., was taken to sea for trial. The *Brilliant* has been built to the order of Messrs. die Deutsch-Amerikanische Petroleum Gesellschaft of Bremen, in accordance with Bureau Veritas requirements for their highest classification, and is on Swan's patent system for the carriage of petroleum in bulk. The vessel is capable of carrying 4,500 tons deadweight, and the machinery is of the triple-expansion type. A series of runs were made on the measured mile, when a mean speed of about 11 knots was attained.

Dundee.—On August 6th the screw steamer *Dundee*, recently launched by Messrs. J. Scott & Co., at Kinghorn, to the order of Messrs. James Rankine & Son, of Glasgow and Grangemouth, and intended for their Grangemouth and Rotterdam passenger and general cargo trade, ran her trial trip on the Forth, the working of the engines and the speed being very satisfactory This steamer was designed and superintended during construction by Messrs. MacNicoll & Co., of Glasgow, in conjunction with Mr. Dewar, superintending engineer for the owners. She is 225 ft. by 29 ft. by 16 ft. moulded, and is fitted with triple-expansion engines, having 19½ in., 32 in. and 52 in. cylinders, 42-in. stroke, and two boilers for 160 lbs. working pressure, all of the most modern type, to indicate 1,100 H.P. The hull is extra strong, with high bulwarks and cellular double bottom, all to Lloyd's highest class requirements. There is ample accommodation for a large number of passengers, and three steam cranes and three steam winches have been fitted to give rapid despatch. She will be commanded by Captain Turnbull, late of the *Amsterdam*, belonging to the same owners.

Tamarind.—On August 7th the steamer *Tamarind* left Bill Quay on a trial trip. The vessel is of the following dimensions —Length, 230 ft.; breadth, 33 ft.; draught, 16 ft. 2 in. She has been built by Messrs. Wood, Skinner & Co., Bill Quay, for the Sondenfjelds Norske Dampskibsselskab, Christiania. The engines, built by the North-Eastern Marine Engineering Co., Wallsend, are triple-expansion, with cylinders 17½, 28, and 47 in. in diameter, by 33 in. stroke, and steam is supplied by two single-ended boilers. The vessel attained a speed of 11 knots on the measured mile, and great satisfaction was expressed both with the working of the machinery and the speed obtained.

Irene.—On August 7th the twin-screw steam yacht *Irene*, which Palmer's Co., of Jarrow, have just completed to the order of the Honourable Corporation of Trinity House, was taken for her maximum speed trial. This vessel was guaranteed to steam 15 knots under natural draught, and 17½ under forced draught, each on a six hours' run. On the natural draught trial the mean speed attained was 15·58 knots. On the 7th inst. th vessel steamed six and a half hours continuously, with an air-pressure in the stokeholds of 1½ in. The mean speed attained was, we are informed, 18·3 knots, or 0·8 knots in excess of the guaranteed performance. The dimensions of this vessel are:—Length, 220 ft.; breadth, 27 ft.; depth of hold, 14 ft. 9 in. She is fitted with twin-screw triple-expansion engines, with cylinders 22 in., 33 in., 50 in. diameter, and 24 in. stroke, which on Thursday's trial developed 2,800 I.H.P. The boilers are fitted up with Henderson's patent, improved, self-cleaning fire-bars. On the occasion of the trial the Trinity Corporation were represented by Sir James Douglass, Mr. F. C. Goodall, and Mr. Ayres, under the supervision of whom the vessel and her machinery have been constructed.

Halifax City.—On August 7th this fine steamer, built by Messrs. Wm. Gray & Co., Limited, to the order of Messrs. Mark Whitwell & Son, of Bristol, originally christened *Bristol*, but subsequently purchased by C. Furness, Esq., and renamed the *Halifax City*, went on her trial trip. She is of the following dimensions—Length over all, 300 ft.; breadth, 38 ft.; depth, 22 ft. 2 in. The engines have been built at the Central Engine Works of Messrs. Wm. Gray & Co., and have cylinders 21½ in., 35 in., and 58 in., with a piston stroke of 39 in., and steel boilers working at a pressure of 150 lbs. per square inch. The vessel passed out into the bay about 6 a.m., and the log being thrown overboard, it was found that she averaged just under 12 knots per hour. Mr. Strachan, the inspecting engineer to the owner, was present, as also Mr. Mudd, on behalf of the engine builders. The trial proved perfectly successful, everything being to the entire satisfaction of the owner's representative.

Charles T. Jones.—On August 7th the new steel screw steamer *Charles T. Jones* proceeded to sea on her trial trip. The *Charles T. Jones* has been built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. Jones & Thomas, Cardiff. Her principal dimensions are as follows, viz.:—290 ft. by 40 ft. by 22 ft. 6 in., moulded, and she is of the improved well-deck type, having poop, raised quarter-deck, long extended bridge and top-gallant forecastle. She is classed 100 A 1 at Lloyd's under special survey; has steam steering gear, direct acting steam windlass, and every appliance for securing efficient and economical working; shifting boards and bulkheads according to Grain Cargoes Act; and is fitted with triple-expansion engines having cylinders 23 in. by 37½ in. and 61½ in. by 39 in. stroke, which are supplied with steam from two large steel boilers, having a working pressure of 160 lbs. The engines and boilers have also been made by Messrs. John Readhead & Sons. After adjusting compasses, the steamer ran to Newbiggin and back, averaging across the measured mile over 11½ knots. Everything worked with the greatest smoothness and gave complete satisfaction to all concerned. The vessel afterwards returned to the Tyne to load for Civita Vecchia, under the command of Captain Thomas.

Chamois—On August 8th the trial trip took place of the s.s. *Chamois*. Her dimensions are 275 ft. by 40 ft. by 19 ft. 6 in., moulded. Built by Messrs. John Priestman & Co., Sunderland, for Messrs. Jackson Bros. & Co., London. Engines by Messrs Westgarth, English & Co., Middlesbro', 21 in., 34 in., and 56 in. by 39 in. stroke, with two boilers, 160 lbs. pressure. Average speed of four runs at the measured mile was 10¾ knots. The owners and their representative, Mr. Dumlin, who were on board, were highly satisfied with the result of the trial.

Pakeha.—On August 8th this steamer, 365 ft. by 47 ft. by 24 ft. 2 in., built by Messrs. Ropner & Sons, Stockton-on-Tees, for the Shaw, Savill & Albion Co., London, left the Tees for her trial trip. The vessel is specially fitted for carrying frozen meat from New Zealand, and is the largest of her class built on the Tees. Her engines are of the triple-expansion type of 350 N.H.P., having cylinders 28, 46, and 75 in. in diameter, by 48 in. stroke, and working at 160 lbs. pressure.

They have been built by Messrs. Blair & Co., Stockton-on-Tees. She made a most successful run, attaining a speed of about 11 knots.

Cape Breton.—On August 9th this new screw steamer went to sea on a trial trip. The vessel, which has been built by Messrs. Osbourne, Graham & Co., Hylton, for the Black Diamond Steamship Co., Montreal, is of about 2,500 tons, and is intended to trade on the Canadian and American coast. The engines, which are of about 900 I.H.P., have been built by the North-Eastern Marine Engineering Co., Wallsend, and throughout the trial worked well.

Poherua.—On August 9th this vessel, recently built by W. Harkess & Son, of Middlesbro', and owned by the Union Steam Shipping Co., of New Zealand, had her trial trip. She was run at full speed for six consecutive hours in the Tees Bay with her water-ballast tanks full (550 tons). A speed of over 10 knots was maintained, and everything found to work satisfactorily. The vessel afterwards returned to the Middlesbro' Docks to load rails for Australia. Her engines are by Alexander Shanks & Sons, Arbroath.

Madagascar.—On Saturday, August 9th, the trial trip took place of the screw steamer *Madagascar*, built by Messrs. C. S. Swan & Hunter for the Cie. Havraise Peninsulaire de Navigation à Vapeur. Dimensions—324 ft. b.p. by 40 ft. by 27 ft. depth, moulded; cargo capacity, 4,200 tons deadweight; engines, 26 in., 42 in., and 69 in., by 45 in. stroke, capable of working up to 1,750 I.H.P., constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend. The trial trip was in all respects satisfactory, and an average speed of 12¼ knots was obtained on the measured mile. The trial was attended by Mr. Paul Grosos, manager of the company: Mr. Hunter, builder; Mr. Irwin and Mr. Phillipson, representing the engine builders; and a party of ladies and gentlemen. The *Madagascar* will leave the Tyne in a few days for Havre and Mauritius.

Arab.—On August 9th the s.s. *Arab*, of the Bedouin Line, of Liverpool, left the Tyne for her official trial at sea. She is the latest production of Messrs. Palmer, of Jarrow, having been built by them for Messrs. W. & R. Thomson, the managing owners of the line, from the specifications and under the superintendence of Mr. George F. Mason, marine superintendent. She is a fore-and-aft schooner-rigged spar-decked vessel, of 2,722 tons register, built to take the highest class at Lloyd's, and was loaded with 6,200 tons of coals for Bombay, under the command of Captain S. Newey. The engines are of the triple-expansion type, with cylinders of 28 in., 45 in., and 74 in. diameter, by 48 in. stroke, having extra large steel boilers working at 160 lbs. pressure. Boilers are fitted with Henderson's patent improved self-cleaning firebars. A complete installation of electric light is fitted throughout the ship. The vessel steamed 11 knots on the measured mile, everything working smoothly and to the satisfaction of those on board.

Allegheny.—On August 9th the s.s. *Allegheny*, the largest oil vessel yet built by Messrs. Craig, Taylor & Co., Stockton-on-Tees, took her trial trip, and it proved very satisfactory, a speed of 12½ knots being easily maintained. The vessel is of the following dimensions—330 ft. by 42 ft. by 28 ft. She is constructed, according to a special arrangement of the builders, for carrying oil in bulk, and will take over 4,000 tons in her tanks. Her triple-expansion engines are by Mr. John Dickinson, of Palmer's Hill Engine Works, Sunderland, and are of the following sizes—25 in., 40 in., 66 in., by 45 in. stroke, with two double-ended boilers 160 lbs. working pressure. She has a magnificent installation of electric light (80 lights), which is worked from the engine-room by a very fine dynamo, driven by one of Hayward, Tyler's vertical engines. Messrs. Hayward, Tyler & Co. have also fitted very superior and powerful pumping arrangements. After the trial the vessel returned to Middlesbro' to receive her bunker coals, after which she will proceed to Philadelphia.

Sunshine.—On August 11th the trial trip took place of the s.s. *Sunshine*. Her dimensions are—250 ft. by 35 ft. by 19 ft., moulded. Built by Messrs. Irvine & Co., West Hartlepool, for Messrs. John Wood & Co., of the same port. Engines by Messrs. Westgarth, English & Co., Middlesbro', 18½ in., 29 in. and 49 in. by 36 in.; 160 lbs. pressure. The engines worked well, and the result of the trial was satisfactory to all concerned.

Avonmouth.—On August 12th this vessel, which is a steam trawler of the most modern type and built by H. Harkess & Son, of Middlesbro', for the Western Steam Trawling Co., of Bristol, had her trial trip, when satisfactory results were obtained, the vessel steaming 11 knots and everything working smoothly. The engines are by the Vulcan Iron Works Co., of Hull. After the trial run the vessel proceeded to Scarborough.

Alfalfa.—On August 13th the s.s. *Alfalfa*, a steel-screw vessel built for Messrs. A. Holland & Co., London, by Sir Raylton Dixon & Co., Middlesbro', took her trial trip from the Tees. This vessel is built on the web-frame principle, having poop, raised quarter-deck, longbridge, and top-gallant forecastle. Her leading dimensions are—Length over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; with a carrying capacity of about 3,300 tons. Her engines, which have been fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland, of 180 N.H.P., having cylinders 21 in., 35 in. and 57 in., by 39 in., proved perfectly satisfactory on trial. This is the sixth vessel delivered to the same owners by her builders during the last three months.

Jose Romano.—On August 13th the trial trip of the new steamer *Jose Romano*, built by the Grangemouth Dockyard Co., took place on the Firth of Forth. Her dimensions are 178 by 25 by 11½ to main deck, 18½ ft. to awning deck. Her engines, which are of the triple-expansion type, were supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow; cylinders, 16 in., 26 in., and 40 in. by 30 in. stroke, and supplied with steam 160 lbs. pressure. On a trial of speed with the vessel loaded an average of 11 knots was obtained, being half a knot over the guaranteed speed. The *Jose Romano* has been built to the order of Messrs. Romano & Co., of Tobasco, Mexico. This is the third steamer built for them by the Dockyard Company, and is handsomely fitted up for 40 first-class passengers, Clark Chapman's steam winches and steam windlass, and Alley & M'Lellan's steam steering gear. Throughout the engines worked smoothly and to the satisfaction of all those concerned.

Rangatira.—On August 14th the s.s. *Rangatira* had a very satisfactory trial trip. Our readers will remember that this is a vessel built by Messrs. Wm. Gray & Co., Limited, to the order of Mr. Christopher Furness, of West Hartlepool, and subsequently sold before being launched to Messrs. Shaw, Savill & Albion Co., Limited, London. She is nearly 400 ft. in length; breadth, 47 ft.; and depth, 29 ft. 4 in., and is built to the highest class at Lloyd's. This vessel is by far the largest that has ever been built at the port of the Hartlepools, and has a carrying capacity of about 6,250 tons. She has been fitted by Messrs. Shaw, Savill & Co. with two complete sets of the Haslam Foundry & Engineering Co.'s refrigerating machinery, the holds being lined all over with a non-conducting material, so as to entirely insulate them from the ordinary atmosphere. This has been done to enable the ship to be put on Messrs. Shaw, Savill's New Zealand line of steamers for carrying frozen meat to this country, and when fully loaded, this vessel can carry over 70,000 carcasses at one time. It is necessary to reflect on the immense size of a flock of 70,000 sheep when seen in the field to realize what this means. The main engines for driving the vessel have been supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, and are of the triple-expansion type, working on three cranks. The cylinders are 27 in., 43 in., and 72 in. diameter, with a piston stroke of 45 in. Steam is supplied by three very large double-ended boilers, containing in all 12 furnaces, all of which lead into one great funnel 10 ft. in diameter. The working pressure of the steam is 160 lbs. per square inch. The engine-room is replete with every modern appliance, and is arranged throughout in the most convenient manner, giving rather the appearance to the engine-room of a large passenger steamer than that of a cargo carrier. The vessel proceeded to sea for the first time at 4 a.m. August 14th, having on board Captain M'Kirdy, the marine superintendent, and Mr. S. S. Carrick, the superintending engineer for Messrs. Shaw, Savill & Albion Co., and Mr. T. Mudd, representing the engine builders. The vessel is under the command of Captain Burton; the engine-room, with its total of 25 hands, being under the charge of Mr. Arthur Hollingworth, chief engineer. The vessel was manœuvred for a couple of hours to the orders of Sir Wm. Thomson's compass adjusters, and afterwards proceeded to the measured mile, the engines being put full speed ahead, when it was found that the average speed taken over four runs was 11¾ knots per hour. Everything continued to work in a perfectly satisfactory manner, there being no water applied to any bearing whatever, and the engines running so quietly as not to be heard on deck. The trial over, the vessel proceeded at once to London, and the following morning a telegram was received showing that she made the run from Hartlepool to the Royal Albert Dock, London, in 24½ hours, against a strong head wind, everything having worked to the superintendent's satisfaction. The s s. *Rangatira* has been fitted with a loose bladed propeller, the blades of which are of manganese bronze, and were cast at the Central Engine Works. The casting of propellers in bronzes is attracting some attention on the East coast for cargo vessels, and has been made a special feature of at the Central Engine Works, where a furnace has been put down quite recently for the special purpose; and although the cost of this metal is considerably higher than either cast-iron or steel, there can be no doubt of the higher speed attained by a vessel so fitted, and the difference is by many owners considered to more than repay the extra outlay. This vessel and her sister ship, the *Tekoa*, which was also built to the order of Mr. Furness, and is now sold to the New Zealand Steamship Company for the same trade as the *Rangatira*, were built at Messrs. W. Gray & Co.'s new shipyard, near the engine works, where vessels up to 500 ft. in length may be built and safely launched. Other vessels of nearly as great capacity are in course of construction at this yard, and the *Rangatira* may therefore be regarded as the commencement of a new era in shipbuilding at the Hartlepools, which will include vessels of the largest type known to merchant shipping.

Benington.—On August 20th the new iron screw trawler *Bennington*, which was recently launched from the shipyard of Messrs. J. P. Rennoldson & Sons, South Shields, had her trial at sea, when the most satisfactory results were attained, the mean speed over the measured mile being 11 miles per hour. The machinery worked throughout the trial without a stoppage, and in the most perfect manner. The *Bennington* is owned by the Boston Deep-Sea Fishing and Ice Co., Limited.

Orontes.—On August 20th the *Orontes*, troopship, Capt. M'Kechnie, having concluded her refit at Portsmouth, during which she had been supplied with a set of new dynamos, went out of harbour for a two hours' trial of her machinery in charge of the Steam Reserve. She was light, having a mean draught of 22 ft. 11 in. The mean pressure of steam recorded during the trial 55·2 lbs., the safety valves being adjusted to blow off at 60 lbs. A speed of 12¾ knots (as measured by patent log) was obtained. The *Orontes* is under orders to leave Portsmouth on the 25th prox. with military reliefs for Alexandria and Cyprus, and on the 10th of December with military details for China; on her return she will be fitted with a new set of boilers.

Nubia.—On August 21st the new screw tug *Nubia*, built by Messrs. Westwood, Baillie & Co., and engined by Messrs. Stewart, of Blackwall Iron Works, for Mr. William Watkins, of 75, Mark Lane, London, had her trial trip. The vessel is 90 ft. long, 18 ft. 6 in. beam, 11 ft. 8 in. deep. The engines are triple-expansion, 350 H.P. effective, and gave the greatest satisfaction.

Sam Handford.—The trial trip took place last month of the s.s. *Sam Handford*. Her dimensions are:—260 ft. by 36 ft. 6 in. by 19 ft. moulded; built by Messrs. R. Craggs & Sons, Middlesbro', for Messrs. Page & Co., London. Engines, 20 in., 23 in., and 54 in., by 36 in., 160 lbs. pressure, by Messrs. Westgarth English & Co., Middlesbro'. The trial was very satisfactory, and the vessel sailed for the Black Sea.

Largo Bay.—The trial trip took place lately of the s.s. *Largo Bay*. Her dimensions are:—287 ft. by 36 ft. 9 in. by 24 ft. 6 in., moulded; built by Messrs. R. & W. Hawthorn, Leslie & Co. for Messrs. Afflick & Co., Shields. Engines, 20 in., 33 in., and 54 in. by 36 in., 160 lbs. pressure, by Messrs. Westgarth English & Co., Middlesbro'. The vessel was fully loaded, and steamed an average of 9·57 knots at the measured mile at Tynemouth, which was considered highly satisfactory.

Hoselnee.—This screw steamer, which has been built for the Bombay and Persian Steam Navigation Co., has had her trial trip. She is 258 ft. long, 34 ft. beam, and 24 ft. 6 in. depth, and fitted with engines having cylinders 19 in., 31 in., 51 in. diameter, by 39 in. stroke, manufactured by Messrs. Alley & McLellan, Glasgow. The vessel is fitted up specially for the Arab horse trade and pilgrim service, and also for about 12 first-class passengers. The engines worked exceedingly well on the trial, giving entire satisfaction, and the speed obtained was 11½ knots.

Escurial.—The steamer *Escurial* of dimensions 230 ft. by 30·2 by 22 ft., belonging to Messrs. Raeburn & Verei, after being refitted by Messrs. James Howdon & Co. with a new main boiler on their forced draught system, was tried at Skelmorlie, after adjusting compasses at Gourock. The steamer was fully loaded, and the mean of the runs at the measured mile up and down was 10·04 knots per hour, with the boiler worked considerably under full power. The engines which are compound—28 in. and 52 in. diameter by 36 in. stroke, working steam pressure 80 lbs. per square inch—have not been altered. The application of the forced draught to this steamer has given, with a smaller boiler than was formerly used, an increase of speed to fully a knot per hour combined with a high efficiency.

Geestemunde.—The steel tank screw steamer *Geestemünde*, lately launched from the Walker shipyard of Sir W. G. Armstrong, Mitchell & Co, was recently taken to sea for trial. The *Geestemünde* has been built to the order of the Deutsch-Amerikanische Petroleum Gesellschaft, of Bremen, in accordance with the Bureau Veritas requirements for their highest classification, and is on Swan's patent system for the carriage of petroleum in bulk. The vessel has a deadweight capacity of about 4,100 tons, which she carries on a moderate draught of water. Her machinery is of the triple-expansion type, fitted with assisted draught on the closed ashpit system, and has been manufactured by the Wallsend Slipway and Engineering Co. Powerful Worthington pumps, connected to a very complete piping installation, have been fitted for dealing with the cargo; and the vessel is lighted throughout with electricity. After adjusting compasses, a series of runs over the measured mile off Hartley were made, when a mean speed of 10½ knots was, we are informed, attained, the machinery working without the slightest hitch.

Reviews.

The Electrical Engineer's Pocket-book of Modern Rules, Formula and Data. By H. R. Kempe. With illustrations. London: Crosby Lockwood & Son, 1890.

THE author's aim is to produce a little manual which will be useful in the daily practice of electrical engineering; all matters of historical or literary interest are therefore avoided. As the title implies, we find no lengthy descriptions but a succession of values in equation form, interspersed with tables. Amongst electrical units, for example, that of electro-motive force is given in name as the volt, the derivation being stated as ampère ohm and the dimensions in C.G.S. units 10^8. Comparing electrical and mechanical equivalents we are told also that 1 Watt = 7,373 ft. lbs. per second, and so on.

The first tables that are met with give the resistances of copper wire, guttapercha, and india-rubber, while as regards primary batteries there are the electro-motive forces of the different forms ready to hand. Full particulars and tables are found on the important subject of accumulators. Under the headings current, resistances and capacity, we find illustrations and galvanometers come in for considerable attention, the subject of testing being well gone into. Conductors take up 50 pages of rules and tables, while on the other hand the section, "Electrical Lamps," seems somewhat meagrely treated in comparison, with its three pages. Dynamos receive as much notice as many pretentious volumes, but transformers are passed over with only a half-page. The expenses of electric light installations are fully set out, and the difference between this system and gas. There is a little also on electro-motors and the relation in the cost of electric transmission as against cables, compressed air and hydraulics. The Board of Trade rules and regulations are found, as also sections respecting telegraph apparatus, telephones, and miscellaneous subjects, such as lightning conductors, gas engines, pneumatic despatch tubes, though what this last has to do with electrical engineering we fail to observe. Not to be behind most authors of pocket-books, there are in the present case a few elementary values in trigonometry, tables of logarithms, reciprocals and square roots. There is evidently a fashion in this as in most other things. More to the point is a concise dictionary of terms, electrical and technical, of general acceptation, as also an index to the book. It will be gathered from our description that there is considerable worth in these 248 pages. If some branches are not quite so strong as others, it does not detract in any way from the merits of the work as a whole. It remains to be said that the author is on the electrical staff of the General Post Office.

Pumps and Pumping. By M. Powis Bale. London: Crosby Lockwood & Sons. 1889.

This work is described as a "Handbook for Pump Users." It is not intended as a treatise on the construction of pumps, but merely put forward as a collection of notes on the subject. It may be premised at once that these are somewhat of an elementary character, and not likely to be of service to anyone who has much acquaintance with engineering details. Communication is so varied nowadays that even if a special appliance is outside the sphere of an engineer's knowledge, there are ample means at his command for at once remedying the defect, and this at first hand. Were he to turn to a book of this kind for information, he would be disappointed we think. There are no illustrations whatever, nothing to convey in form what is expressed verbally. This is a great drawback in a work of a technical nature. It may be said, however, that engineers are out of the question, as users only are looked to for readers. Supposing then that users attempt to do without professional services, as is sometimes the case, much to their cost, we will endeavour to estimate the value of the book on this basis. Under the heading, "Selection of a Pump," the chief points said to be desired are simplicity, easy access to the working parts, certainty of action, good working at varying speeds with small expenditure of power, and the delivery of a fairly constant stream of water. Amongst other directions the reader is advised to remember that the pressure of steam as well as the diameter and stroke of the cylinder settles the power, and that a slow piston speed gives a good vacuum, and consequently a better useful effect. These quotations show that considerable technical ability is assumed on the part of the average pump user. The quality of the metal employed in the construction has to be watched by him also. It should be, we are told, of hard, grey cast-iron, fitted and bored equal to a first-class steam-engine, with piston-rods and pins of steel points, case-hardened, &c. This and more of the same kind clearly proves, whatever the author may say to the contrary, that the layman will not be able to follow him very far. Still there are in out-of-the-way situations abroad possibly some to whom directions like this may prove useful. Those in charge of machinery are often pitchforked into their positions in up-country places for want of proper men.

The arrangement is by paragraphs and headings in large type. In some cases the descriptions are only a few lines, while in others they go up to three pages. We may quote a few as follows—Cornish pumping engines, Pumps for underground work, Hydraulic pumping engines. This last is said to be used chiefly in large mines as an auxiliary aid to the ordinary pumps in case of stopping or flooding. Though this may be correct, what about engines for pumping up accumulators in hydraulic installations? No mention is made of these generally understood hydraulic pumping engines here, where we expect to find them. Under "Independent condenser pumps," we are told that, owing to the increase of speed in modern engines, in lieu of a pump driven by the engine, it has been found desirable to employ an independently-driven air pump and condenser. The reader's imagination must be taxed to gather the class of engine to which this remark applies, whether land or marine. One paragraph, entitled "Pounding in pumps," has a full stop after it and long break, though it is really the subject of the verb "may arise," which follows immediately after with a capital letter. This is, of course, an error in the press. A peculiarity of this book is that the names of the makers are studiously withheld, for what purpose we are not aware, except it is to induce business inquiries, in which case we should have thought the catalogue style would have been more advisable. When we turn to "Air and circulating pumps for surface condensers" we find it stated that when these pumps were run off the main engines it was in too many cases at too high a speed for economical working. It does not seem to have occurred to the author that by having independent circulating pumps the first object was rather the getting a vacuum before starting the main engines. Besides three pages of formulæ respecting centrifugal pumps and a table of figures relating to hydraulic rams in the middle of the volume, at the finish there are no less than 19 pages devoted to a collection of rules, also pressures and weights of water at different heads and diameter of pipes respectively. Considerable skill would be necessary to utilise these instructions. Generally in a work of this kind much more fulness should have been aimed at. It is now neither one thing nor the other, unsuitable for engineers, and beyond the scope of those who have not received a workshop education. Moreover, a subject like pumps is, in our opinion, better dealt with as an auxiliary to the various branches of engineering rather than as a primary matter treated in a small way. Though a pump is a pump all the world over, an enquirer, say, upon marine pumps would probably be inclined to expect a work on marine engineering to supply him with what he wanted, so also in brewing, waterworks, drainage, and all through the list. The difference in the necessities of these particular fields produces a variation from the main features to suit the required conditions, and this variation follows naturally with the subject in hand.

Electric Light Fitting. By J. W. Urquhart. London: Crosby Lockwood & Son. 1890.

We have authors of various types in technical literature. The most plentiful is perhaps the professor, who delights in involving his readers in mathematical formulæ which serve to illustrate his own particular theories. The layman if he ventures to protest is compelled to retire in the one-sided argument. He is innately voted an ignoramus. Yet everyone knows that in ordinary work it is the application of rules that alone is of value, and very little of the bases on which these are framed goes a long way. Unfortunately, however, for the public the teaching class is not happy without it is forever rushing into print both in season and out of season. Thus it is that publishers of engineering works are numerous, and quantity predominates over quality. In the present instance we have an exception to the above dictum. The author is engaged practically as an electrician, and he endeavours to show the difficulties that are encountered in electric light fitting, and the manner of meeting them. A knowledge of the subject is presumed, and to quote the words of the preface, "the contents are arranged more in accordance with the natural sequence of the work of electric lighting than in relation to the relative importance of the subjects." No attempt is made to form a text-book but to put together the daily notes of one engaged in this department. We commence therefore upon central station work, and are told first what anyone in charge is required to know in the way of first principles. Diagrams and descriptions follow of the different modes of regulating the current supply to the demand, also a short essay on the management of dynamo machines. This last is detailed to items like belting. Several pages are devoted to brushes and commutators with their treatment, also the method of testing generally adopted. In the directions to attendants it is said that shocks of over 1,000 volts have been taken freely by some persons, while even by touching a wire with one hand severe results have occurred occasionally. With regard to faults, engineers will not be disposed probably to agree with the author that the motors should generally take all the blame due to bad workmanship. This is a common acceptation with electricians, presumably to shift the responsibility from their own shoulders. The leading causes of failure are afterwards summarised in short circuiting and bad contacts. The question of armature repairs being discussed we find hints to accumulator attendants. In this connection there is also an explanation of the leads and contacts to the accumulator and dynamo. Very full directions are given as to the switching-in of new machines when the load becomes great. It is shown how this was formerly done by means of an artificial bank of lamps, this plan being now superseded by iron or carbon resistance frames. This synchronizing of two dynamos working in parallel is a very delicate operation, and cannot be effected unless they are of the same period and moving at the same speed. Here is where measuring instruments become a necessity, and an introduction is thus found to the description of the principal forms. These are all illustrated. On page 74 the "practical" electricity of schools, class-rooms, and laboratories is said to be frequently so different from that of an electric lighting station that it is thought desirable to say something respecting the taking of resistances. A rough and ready method is described, besides those in use in general practice. Up to this point we have only had a preliminary to "Electric Light Fitting," the title of the volume.

The arc system is then treated with its various modifications. These are said to be chiefly in the direction of making the lamps suitable for either constant current, or constant potential. Trimming is noticed with some degree of detail. On the matter of circuits, leads and insulators are also gone into closely. In planning a system of mains and feeders the Germans construct a small working model on a large frame, we are told; whereas in this country calculations are made on a basis of 1,000 ampères per square inch sectional area of leading wire, and the results put on paper. The important branch of transformers is diagramatically shown as regards their action. The principle upon which they depend, being commonly found in text-books, is not repeated here. It is advised that they should be placed outside a building and in a fireproof chamber.

When the incandescent system is reached, we are shown the conditions that present themselves to an electrician, and how he should set about carrying the requirements into effect. Skeletons are found of parallel wiring, the series-multiple, the three-wire series, and the multiple-series methods. With so many from which to choose, something is said for and against them all. The opinion is expressed, that with alternating and continuous currents there is about the same wastage of the filament in both cases. With the former, however, it is more evenly distributed than with the latter. On page 146 is a table relating to wiring, giving the sizes, resistance in ohms, safe working current, and the approximate number of lamps usually run on the wires. As these figures are well-tried ones, they should be of value. Besides a variety of the well-known kinds of switches illustrated, there is also that of a reversing form, due to a French electrician by which the operation may take place from two points, say from two ends of a room. In going into the types of lamps, the range of volts and ampères each size will take is given. What circumstances affect the life of a lamp are also noticed. Upon the question of the economical pressure to run them at, if this is low, it is argued that from the blackening of the globe that follows after a certain length of time, the filament, though capable of more work, must be sacrificed. A rule is put forward to solve this difficulty, also means for obtaining the power for any given installation. The importance of jointing the conductors properly is well understood, and several pages are allotted to this subject. So clearly is this done that an amateur might very well follow the directions laid down and make a very fair job at the end. The sixth chapter relates to ship lighting. A slow-running machine is considered the best for this purpose, with a self-regulating current and pressure suited to the lamps. We are at one with the author that direct-driving engines are a *sine quâ non* in the light of present experience on board ship. Other points having been touched on under the several heads, single-wire work only remains for further attention. We find also illustrations of Suez Canal projectors and comments thereon. A sufficiently good index completes the volume, which is neat and handy. On the whole a creditable addition has been made to this branch of literature, and anyone charged to carry out or manage an installation will do well to provide himself with a copy.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

FAST STEAMING.

To the Editor of The Marine Engineer.

Sir,—In looking through the Miscellaneous column of the Marine Engineer of August 1st, and touching electric light in the Suez Canal, will you kindly allow me space in your valuable paper to contradict a statement of the shortest time made by a steamer in the transit of the Suez Canal in 1889, the time being 14¾ hrs., and also giving it to be 10 min. less than the fastest passage on record.

I have made the transit of the Suez Canal, from Port Said to Suez, in 13 hrs. 55 min., from which deduct a stoppage of 30 min. at the 25 mile (Gare), bringing the total steaming time down to 13 hrs. 25 min., which is 1 hr. 20 min. less than the recorded fastest passage on record as given in your August number of 1890.

The above passage was performed by the American steam yacht *Namouna*, a vessel of 616 tons register and 250 N.H.P., on the night of the 29th—30th of January, 1887.

From yours truly,
Geo. Warren.

GLASS FOR EXAMINING THE OUTER BEARINGS OF A SHIP WHEN AFLOAT.

To the Editor of The Marine Engineer.

Sir,—I send you some particulars which I think are worth a place in your monthly paper.

I would recommend that every steamship should carry a telescope or looking-glass, for examining their outer bearings when afloat.

A temporary one I made about thirty years ago while engineer of one of W. H. Dixon's steamers, trading to the Mediterranean, consisted of a box about 2 ft. long, large enough to take in the two eyes, with a piece of common glass made watertight in the lower end,—the way and time I used this was when getting ready to leave the port of Syra, while the captain and the agent was in the cabin settling their business. The agent's boat was at the gangway. I took my box, stepped into the boat, and went to the stern; put my box in the water, it being quite clear, to have a look at the propeller, when I saw at a glance that the cotter was out of the propeller, and as there was no nut to prevent the propeller from slipping off the shaft, I did not know what to do. I quietly went to my cabin and wrote a note to the captain, letting him know the state of affairs. He came out and asked what I intended to do. I told him it would be all right if he kept the engines going ahead, and not to back them: that we could proceed to the next port, which we did safely, being Gallipoli. Having the dimensions of the cotter in my pocket-book I went on shore and after some difficulty got sufficient iron to have a cotter made; and by good chance there was a diver and dress in the port who fitted it in, which kept good until we got to Liverpool. By the aid of this glass I could count every rivet visible in the keel. By the aid of such a glass the engineer of the *City of Paris* could have seen if there was any defect in the outer bearings before leaving New York.

Yours respectfully,
Alexr. Watson.

37, Harland Road, Tranmere, Birkenhead,
July 1st, 1890.

THE NEWHAVEN AND DIEPPE SERVICE.

To the Editor of The Marine Engineer.

Sir,—On page 226 of your August number you note the trial of a new steamer for this service, but there is, unfortunately, a slight mistake. According to the specification the new steamers (twin screws) were to accomplish the passage from Dieppe to Newhaven and back again to Dieppe in nine hours, thus allowing four hours and a half each way. The *Caen* made the trip from Dieppe to Newhaven in just five hours, the delay being due to one of her boilers giving out. On the return trip she made the passage in 3 hrs. 58 min., not 48 min., as you state; she thus accomplished the double trip in 8 hrs. 58 min., or 2 min., only under the specified time. It may be stated, however, that her fastest passage since her trial has been 4 hrs. 10 min. The fastest passage of the second steamer, the *Angers*, has been 4 hrs. 3 min.

Now these are not extraordinary speeds, considering their pressure and power. The *Lyons* and *Italy*, which were built for the service by the Fairfield Co., of Glasgow, in 1885, have done the passage frequently in 4 hrs. 20 min.; they are twin screws, each propeller being driven by one high 22 in. diameter) and two low (32 in. diameter) pressure cylinders, by 24 in. stroke, steam being generated by *two* boilers at 110 lbs. pressure. The *Caen* and *Angers* are triple-expansive, each propellor being driven by cylinders, 16½ in., 24$\frac{7}{16}$ in., and 37 in. diameter, by 25 in. stroke, steam being generated by *three* boilers at 142 lbs. pressure. That is, with one and a half times the boiler power, and 32 lbs. more pressure, the *Caen* and *Angers* do the passage only a quarter of a hour faster than the *Lyons* and *Italy* have done it! What have the French shipbuilders to rejoice about?

While on the subject I may state that our oldest screws, built in 1875, have done the passage in 5 hrs., so that to specify half-an-hour less time is not much improvement in 15 years.

I am, yours, &c.,
One in the Service.

THE NAVY.

To the Editor of The Marine Engineer.

Sir,—Kindly favour me with space to point out the great importance of the middle line bulkhead, from stem to stern, for dividing the enormous compartments of iron vessels, which is unattended to in 22 of our large warships; I beg that you will afford me valuable assistance by publishing what follows.

It is now 20 years since a powerful committee was constituted and decided that the central bulkhead was essential to the safety of warships, and that the compartments should be as small as convenience would allow. This wise recommendation has been since acted upon by all nations, with twin screws and separate engines.

We have, however, 20 out of 77 armoured vessels (to be ready in 1894) which, having been built prior to the committee's strong report, have been left without this necessary protection, and are also destitute of the armoured deck. The loss of the *Rè d'Italia* and *Grosser Kurfürst*, and many of our merchant vessels, with great loss of life, indisputably proves the absolute necessity for dividing the enormous compartments as proposed; also the foundering of our *Amazon*, *Vanguard*, and *Sultan*. Again, we have example in the foundering of the *Oregon*, struck by an unknown schooner. But on the safety side, we happily have the valuable experience of the *City of Paris*, preserved from going to the bottom likewise in consequence of the wise forethought of her owners in dividing her hold and engines with suitable compartments.

Continuing to disregard these warnings and examples and to allow our sea-going warships to continue with their vitals unprotected, and thus to wilfully risk the lives of our sailors, with the loss of a battle (from the sinking of one or more ships, as happened to the Italians at Lissa), can only be regarded as a criminal omission on the part of our authorities. To prevent the possibility of mistake, I append the names of vessels which, mainly from this most vital fault, are quite obsolete. Besides, they have obsolete engines, using enormously more coal than the modern ones, single screws, slow speed, rudders and steering gear exposed to destruction by gun fire, soft and thin iron armour, thoroughly obsolete armaments, &c. As these ironclads are not worth bringing up to modern requirements, their places ought to be immediately provided for by laying down vessels of the *Rurick* class. Instead of which their lives are being prolonged by very large outlays, but when the money is expended the result will be most dangerous, obsolete vessels. I can only account for this mistaken measure by supposing that the Navy having been so starved by parsimony, it is considered advisible to keep up a numerical strength.

The following are proved, and it is no longer a matter of opinion only, very dangerous vessels, on account of their enormous compartments:—*Neptune*, *Superb*, *Sultan*, *Hercules*, *Bellerophon*, *Swiftsure*, *Triumph*, *Audacious*, *Invincible*, *Iron Duke*, *Monarch*, *Minotaur*, *Agincourt*, *Northumberland*, *Achilles*, *Black Prince*, *Prince Albert*, *Scorpion*, *Wivern*, *Shannon*. Thus 20 out of 77 (in 1894), or more than one-fourth, are truly dangerous; or why do all nations divide the cross compartments of all new vessels? The *Alexandra* and *Téméraire* are very much better, but have their compartments undivided for 80 ft., which should be divided immediately—total, 22.

We have ten transports in the same dangerous condition, carrying from 1,000 to 1,500 human beings. The *Birkenhead*, *Megæra*, &c., are forgotten. In addition to the above-named 22 armoured vessels we have 20 with twin screws, but otherwise obsolete, of which *Inflexible*, *Dreadnought*, *Thunderer*, and *Devastation* are the only formidable vessels. The rest are a discredit to a British Navy List.

The above 42 are beyond the 35 modern armoured vessels—viz., 26 battleships and nine cruisers, of which battleships two are armed with obsolete muzzle-loading guns.

Our cruisers are even in a worse condition, as we need many large vessels of great speed and coal endurance.

I am, Sir, your humble servant,
Torquay. Admiral of the Fleet, THOMAS SYMONDS.

THE launching of the first cruiser at Bilboa took place on the 30th August in the presence of the Queen Regent.

A NUMBER of engineers recently visited the works of Messrs. Easton & Anderson, by invitation, to see a set of pumping engines constructed by the firm for Brisbane Waterworks. Three independent compound vertical tandem engines stand side by side. They will indicate about 300 H.P., at 20 revolutions per minute, with steam of 100 lb. pressure. Owing to the frightful cost of building in Brisbane, the space available has been reduced to a minimum. The design of the engines is peculiar.

Miscellaneous.

A DANISH ICE-BREAKING STEAMER.—The ice-breaking steamer *Nijoluir*, built at the Elsinore Iron Shipbuilding and Engineering Co., Elsinore, Denmark, for account of the Danish State Railways, had a very satisfactory trial trip in the Sound last month. The *Nijoluir* is built entirely of steel, to Bureau Veritas highest class, and her principal dimensions are:—Length, 135 ft.; greatest breadth, 33 ft.; and depth in hold, 14¾ ft. She is intended for ice-breaking in the Great Belt, and is fitted with three large water tanks, through the medium of which she can be very rapidly adjusted to the desired depth. She has special davits for the purpose of taking up ice boats under special circumstances. The stern portion and the rudder are of cast Swedish steel (Bofors) of specially strong construction, and the dimensions and quality of the material correspond with the severe use to which the *Nijoluir* may be put. The engines are compound with a capacity of 1,000 H.P., with ordinary working. During a four hours' trial the consumption of coal was 18 per cent. smaller than stipulated in the contract. The average capacity at one trial was 1,365 H.P., against 1,200 H.P., as stipulated in the contract, and with 1,018 H.P. a speed of 12 knots was made. Several steering and other trials were also undertaken, which proved equally satisfactory, and from the tanks 70 tons of water were disposed of in 11 minutes.

FAST ATLANTIC STEAMING.—THE RECORD BEATEN.—New York, August 13th.—The *City of New York* has just made her fastest trip, and become one of the quartette of vessels which have crossed the Atlantic in five days. But she required three hours and two minutes longer than the *Teutonic*, which has established the first record of 5 days 19 hours and 5 minutes, or 13 minutes quicker than the *City of Paris*. The feat of the *Teutonic* is remarkable for its hourly average of 20 and 17·00 knots. On her fastest day she covered only 512 miles, which is three under the *City of Paris's* 515. The two ships were within sight of each other until Sunday. On the same subject the New York correspondent of the *Daily News* says:—An ocean race between the *Teutonic* and the *City of New York* ended to-day in a remarkable victory for the former vessel. The *Teutonic* arrived over three hours ahead of her rival, beating the best record ever made by 13 minutes. The time from Queenstown to Sandy Hook was 5 days 19 hours 5 minutes. As she came up the bay the *Teutonic* was continually saluted by passing vessels, and received with shouts of welcome by an immense crowd which had assembled at the pier. On the first day the vessel made 473 miles, on the second 496, on the third 512, on the fourth 500, on the fifth 485, and during the 19 hours of the sixth 340. The first day's run was made against a strong south-easterly breeze. The wind then shifted to the north-east, and blew strong, and the *City of New York* was lost sight of on the second day. During the last 48 hours the *Teutonic* encountered variable winds, but the weather throughout the voyage was good. The average speed for the voyage was 20·175 knots.

"PALFREYMAN'S RUST PREVENTIVE."—We have received a sample of this preventive, and have given the same a trial on several descriptions of bright metals, and we find that it amply performs what is claimed for it, and that it effectually protects whatever it is applied to from tarnishing, rust, or corrosion. It is a very superior material, prepared especially for the preservation of all bright metal surfaces, no matter how severe the test may be. When applied it will not evaporate or dry, nor leave a gummy residuum to absorb oxygen, as is the case with the usual substances employed for this purpose. It is put up in neat tins, and is always ready at hand, requiring no preparation, and it is easily applied and removed. A very slight or heavy coating (according to circumstances) applied to the bright parts of engines tools, machinery, or bright steel, iron, copper, brass, plated goods, &c., will, without staining or otherwise tarnishing, thoroughly protect the parts from rust or corrosion, and bright goods may thus be packed for the foreign as well as the home ports, and reach their destination with the same finish and trueness with which they left the maker's works. It has the further advantage of being economical, as it will cover three times as much bright surface as any other preparation sold for the same purpose. We may add that the manufacturers, Messrs. W. H. Palfreyman & Co., of 87, Piccadilly, Manchester, have sent us a long list of firms that are using their preparation, among whom we notice the names of the principal railway companies, engineering firms, and shipbuilders, &c., in the kingdom.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from July 16th to August 15th, 1890.

10972 W. C. Morison. Marine sounding apparatus.
10993 J. Jackson. Marine steam-engines.
11003 J. Peel. Lubricators.
11082 J. Whitehead. Supplying fuel to steam boiler furnaces.
11087 W. Kilvington. Manhole doors for steam boilers.
11103 W. W. Horn. Steering propeller (D. J. Reynolds, U.S.A.)
11112 J. P. Bayly. Valves for steam-engines (W. Wright, U.S.A.)
11117 A. D. Estienne. Packing used for stuffing-boxes.
11147 A. Mac Laine. Steam-engines.
11148 J. Y. Johnson. Marine and land boilers (William Russell, British Burmah.)
11179 M. C. Macleod. Ships or vessels.
11212 W. Hollis. Ships' propellers.
11233 C. Wells J. Kemsley, and C. A. C. Treemer. Steam-engines.
11260 G. G. Picking and W. Hopkins, Cylinders of duplex direct-acting steam and other pumps.
11321 W. Ockendon. Steam boiler flues.
11330 Peter Haden. Lubricating the stem tube bearings of screw steam vessels.
11422 J. Turnbull. Steam-engines.
11518 W. F. Briggs and W. T. West. Stop valves.
11615 R. T. Moore. Motive power engines.
11631 A. Gnhraner. Valve motion for steam-engine.
11632 A. Guhrauer. Distributing regulators for steam-engines.
11694 F. Hoffman. Steam traps.
11698 J. T. Towlson. Controlling steam or other fluid motive power engines.
11743 C. Wells. Steam-engines
11779 G. G. Picking and W. Hopkins. Automatic boiler feeding apparatus.
11824 C. Brown. Steam-engines.
11867 C. Phillips. Attachments for feed water injectors.
11929 R. W. Allen. Marine engines.
11939 J. Sutton. Pumps.
11944 S. Bruno and O. Barbosio. Propelling apparatus for ships.
11951 G. Weston. Relieving steam or other slide valves.
12017 O. J. Ellis. Rotary engines.
12042 J. W. Macfarlane. Mechanical stokers.
12059 A. Mahew. Steam boilers.
12060 D. J. Dunlop. Screw propeller engines.
12067 T. R. Thomas. Marine governor.
12120 E. Prenveille and P. Stein. Crank shafts.
12126 P. M. Baxter. Cylinders of triple-expansion engines.
12162 W. J. Ewing. Marine engines.
12164 Leon Serpollet and La Société des Générateurs à Vaporisation Instantanée (Système Serpollet). Instantaneous steam generators.
12218 T. Ma Carter and T. Cooper. Motive power engines.
12267 W. R. Chester. Steam boilers.
12283 W. Thomson. Steering, reversing, stopping and starting gear.
12293 W. Lord. Fire bars for steam boilers.
12303 T. A. Crompton. Finding the actual water level in boilers of every description
12349 T. Griffiths and T. Henry. Jet propulsion.
12353 J. Kirby. A dismountable steam boiler.
12361 J. MacHaffie. Propellers.
12455 B. B. Dudley, the Thames Ironworks, &c. Co., Limited. Marine and other engines.
12463 W. R. Rae. Steam-engines.
12471 H. E. Newton. Boiler furnaces (G. Joseph Cartwright, Australia.)
12514 G. Little and J. Stevenson. Feeding fuel to boilers and furnaces.
12523 C. Stuart. Reducing valves.
12537 J. Callister. Screw prepeller.
12575 G. Quick. Vehicular and marine propulsion.
12622 O. L. Ward Balance slide valve for steam engines.
12633 J. N. Aronson. Steam boilers.
12685 J. Cleminson. Exhaust steam discharge pipes of steam engines.
12702 J. P. Bayly. Water alarm for steam boilers (James Macfarlane, U.S.A.)
12723 P. R. Cody. Multitubular steam boilers.
12749 W. H. Thompson. Marine engines.
12754 E. C. Urry and G. A. Farini. Steam feeding apparatus.
12778 S. Milne. Cut-off valve gear of reciprocating motive power engines.
12808 R. Charlton. Reducing valves.
12813 W. Stubbs. Valve gear for steam-engines.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1 C, denotes First Class; 2 C, Second Class.

EXTRA FIRST CLASS.

August 9th, 1890. Ferris, N. F. .... Extra 1C London

July 26th, 1890.

Allam, Alfred ..	2C	London
Bellas, P. T. ..	2C	Sunderl'd
Boyd, Wm. M.	1C	L'pool
Blay, W. H. ..	1C	S'ampton
Campbell, Wm.	2C	Liverpool
Clark, Herbert	1C	Sunderl'd
Codd, John	2C	L'pool
Crane, Arthur..	2C	N.Shields
Creak, Thomas	1C	Glasgow
Cuthbertson, C.	2C	,,
Currie, W. G. ..	2C	,,
Dart, D. D.....	2C	London
Davies, John W.	2C	L'pool
Devlin, John ..	2C	Glasgow
Dick, Francis ..	2C	Snnderl'd
Duncan, A. C...	2C	Aberdeen
Fenwick, James	2C	London
Gerrie, A. B....	2C	Aberdeen
Gill, Henry R.	2C	N.Shields
Grant, Alex. ..	1C	L'pool
Hall, Alex.	2C	Aberdeen
Harper, Thomas	1C	Sunderl'd
Hay, Thos. Alex.	2C	N. Shields
Howgate, Ed. J.	2C	Sunderl'd
Hutchinson, H.J.	2C	,,
Jones, Henry A.	1C	,,
Kennedy, Wm. J.	1C	,,
Kerruish, Chas.	1C	L'pool
Kidd, John	2C	N. Shields
King, C. P.	2C	London
Lewis, John W.	2C	Cardiff
Lynn, Matth. W.	1C	Sunderl'd
Malmsey, Otto C.	2C	N.Shields
McNaughton, J.	1C	L'pool
Miller, Arthnr C.	2C	Glasgow
Mooney, T. Y.	2C	London
Nicol, Andrew	1C	Sunderl'd
Palmer, John J.	2C	N. Shields
Park, B.	2C	Sunderl'd
Potts, Edwd. C.	1C	N. Shields
Reid, James ..	2C	Aberdeen
Ritcaie, W. W.	2C	,,
Robertson, A.W.	2C	,,
Robertson, Patk.	2C	N. Shields
Starling, S. E.	2C	,,
Urquhart, F. ..	2C	Aberdeen
Volum, A. P. ..	1C	,,
Walker, John W.	2C	Liverpool
Walker, W. E..	2C	N. Shields
Wilson, Arch. ..	2C	Glasgow
Wilson, Robt. H.	2C	Sunderl'd
Wilson, W. C...	2C	Aberdeen
Wilson, Walker	2C	N.Shields

August 2nd, 1890.

Allinson, Jno. E.	1C	L'pool
Burke, M. J. ..	2C	,,
Burn, Benjamin	2C	N. Shields
Cartlidge, Harry	2C	London
Dawson, W. ..	2C	N. Shields
George, T. J. ..	2C	,,
Goodman, Geo.	2C	Falmouth
Keldie, Wm. ..	1C	N. Shields
McLaren, John	2C	L'pool
Marshall, James	1C	London
Marshall, S. H.	2C	N. Shields
Park, Alexander	2C	L'pool
Robertson, J. A.	1C	,,
Stewart, Wm. T.	2C	,,
Wilson, T. W.	2C	N. Shields

August 9th, 1890.

Akehurst, E. H.	2C	London
Boyd, Isaac	1C	L'pool
Brown, James..	2C	Leith
Campbell, J. W.	2C	London
Dickie. W. M...	2C	Leith
Dnndas, Thos. L.	2C	,,
Flawith, G.....	2C	N. Shields
Girdwood, J. F.	2C	Leith
Kemp, Fred ..	2C	N. Shields
Mackintosh, Jas.	1C	Leith
Millar, Geo. E.	1C	London
Ramshaw, R. A.	2C	N. Shields
Sinclair, Chas G.	2C	London
Steven, John C.	1C	Leith
Taylor, James	1C	,,
Timbs, W.S O.G.	1C	London
Wiles, Fredk. S.	1C	,,
Williams, Jno. J.	1C	L'pool
Williamson, A.	2C	London

August 16th, 1890.

Braidwood, W.	2C	L'pool
Brown, Peter ..	2C	Dundee
Cameron, Geo. A.	2C	L'pool
Carswell, Robt.	1C	Dundee
Downie, Andrew	1C	Greenock
Fraser, Frank..	2C	N. Shields
Fraser, John ..	1C	Greenock
Fulthorp, W. C.	2C	N. Shields
Fulton, Robert	2C	Dundee
Graham, Thos.	2C	N.Shields
Henderson, J. G.	2C	L'pool
Heron, William	1C	Greenock
Jarvis, James B.	1C	Dundee
Little, Robert ..	1C	L'pool
Marshall, J. I.	2C	N.Shields
McIntyre, A. J.	1C	Greenock
McMeekin Jas.	2C	Greenock
Melville, Alex.	2C	Dundee
Murray, Robert	1C	Hull
Payne, George..	1C	Greenock
Scott, Thomas	2C	Hull
Smith, James ..	2C	N.Shields
Still, James H.	2C	London
Taylor, Walker	2C	N.Shields
Walker, Geo. W.	2C	L'pool

The Marine Engineer.

LONDON, OCTOBER 1, 1890.

MANY claims have been made for the more general adoption of collapsible boats on board passenger and other vessels, since by their collapsibility a much greater quantity of boat accommodation than is usual can be readily stored without occupying as much space as would be required for the non-collapsible boats. It may be that the general adoption of such collapsible boats, for convenience in storing, has not been widely spread, owing to some doubt on the part of shipowners or sailors as to the reliability and safety in a rough sea of such boats as are constructed to collapse. This point seems to have been satisfactorily answered and put at rest by an adventurous voyage successfully undertaken by Captain J. W. Cook and two seamen in a "Berthon" collapsible boat from Southampton to Liverpool in May last. The first part of the run, a distance of about 240 miles, was made from Southampton to Sennen Cove, in Whitsand Bay, to the north of Land's End, where they were detained by high winds from the northwards for several days. They started again with a shift of wind to the south-west, which blew a gale and suddenly chopped round to the north-west, obliging the boat to take refuge at Padstow. When it was possible to start again the wind blew so violently as to amount almost to a hurricane, and under a close-reefed lug-sail they made nearly eleven knots. They were at times completely swamped, and they considered the boat was only saved by her air-cells. They were then obliged to lay to with a sea-anchor, and rode to it for thirteen hours without shipping any water. The warp to the sea-anchor eventually parted with the strain, but they rigged up an iron bucket with another warp as a drogue or sea-anchor, which enabled them to hold on until the close-reefed main-lug was set, and they scudded before the gale into Milford Haven. On departing once again they sighted a small smack of sixty tons, with her main-boom carried away, and Captain Cook, though labouring heavily, was not going to desert a comrade in distress and boarded the smack. Here it is claimed that in so rough a sea any other boat of ordinary construction would probably have been staved in, but in spite of the series of concussions the longitudinal elastic framing of the "Berthon" collapsible boat suffered no damage. Captain Cook and his men, aiding the sailors on the smack, got some sail on her and helped to pump her out, and finally brought her safe to Newport Pier. On setting-out again from Newport in June, which this year had all the characteristics of a winter's month, they were again met with a gale, which eventually shifted right in their teeth, obliging them, with several other vessels, to lie at anchor, weather-bound, at Pwllhely. They eventually set sail again and arrived safely in Liverpool after one of the roughest passages for a summer's month that can well be imagined. During the time of actually running under sail the patent log on board frequently indicated 10 and 11 knots. The boat was most minutely inspected by order of the Board of Trade by their surveyors before starting, and on their arrival at Liverpool, and no injury or strain could be detected. The construction of the "Berthon" collapsible boat is probably well-known to our readers. All her timbers are fore and aft, jointed at the top of the stem and stern posts. When the boat is shut the ribs fall down parallel to the keel, but when opened they take certain definite positions, extending two skins of very strong waterproof material. The body of the boat is thus divided into eight watertight cells, which fill themselves with air in the act of expansion, and the boat is thus a species of perfect lifeboat, which will float even when loaded and full of water.

THE hardships—not to speak of the dangers—of those who "go down to the sea in ships" have, within recent years, more than before, formed the subject of keen comment, if not of ameliorative effort; but it is questionable whether anything so well calculated to arouse general interest in the subject has appeared for several years as the special report which is given in a recent issue of our medical contemporary, the *Lancet*, on the accommodation provided on board ship for firemen and seamen. These men, according to this journal, have but 72 cubic feet of space, while convicts in prison enjoy 370 cubic feet, and prisons are more carefully ventilated than ships. The cabins occupied by the firemen are the worst. Here the clothes, saturated with perspiration, and covered with dirt acquired in the stokehold, are hung up to dry, and they have no special place to wash and to change when they come off duty. The fearful heat of the furnaces soon incapacitates some from work, and as there are never any extra hands, those who can bear up have to do extra work, toiling, it is averred, for two watches of six instead of four hours; making twelve hours a day in the stokehold. Thus the strongest in their turn are invalided. Sometimes, it is averred, a man may go down the stokehold in sound health, and yet, in an hour or two, be so overcome that he is unable to climb on deck again, and has to be hoisted or carried on deck. Firemen frequently suffer from severe cramps, the muscles so contracting as to stand out like thick ropes. The men suffer excessively, till their mates lay them down and by persistent manipulation restore the contorted muscles to their normal condition. A difference of 35 deg. Fahr. between the temperature of the deck and the stokehold is sometimes recorded, and the steps and rails of the iron ladders are often so hot that they cannot be touched with the bare hand. So great are the hardships and the exposure to heat that firemen, according to this report, very generally break down after six or seven years' work. Now, while giving thus fully the gist of our contemporary's indictment of shipowners and others, responsible for the housing and welfare of those who "serve at sea," we are not to be taken as supporting all that is averred, or as crediting that such an alarmist statement of the condition of affairs is true of our merchant marine as a whole. The comparison drawn between the amount of air space allotted to seamen and firemen and that allowed to culprits in jail is inapt. There is a wide difference between solitary and continued confinement in a dark, dismal, even though well-ventilated, den on shore, and the open and airy accommodation in the forecastle of an ocean-going steamer; especially as never at any one time do the full complement of inmates occupy the allotted space or accommodation. As regards baths for firemen; there is doubtless more reason for fault-finding. In many of our first-class mail steamers, however, especially those trading to the East, the provision of such necessaries as bath rooms, lavatories, &c., is well attended to, but doubtless hundreds of instances may be found of a decided lack of such features on board vessels where the need is quite as great. As regards the excessive heat in stokeholds, it cannot be denied. Indeed, we consider this has long been a grievous blot upon the proud record of marine engineering progress. The adoption of forced draught, incidentally, has ameliorated the condition of affairs in the stokeholds of many of our mail steamers and warships; but still, in the vast majority of cases, the poor stokers on board fast steaming vessels are worthy objects of commiseration. We don't suppose it is possible—on present lines at least—for the evil to be completely remedied, but we can at least express the hope that the *Lancet's* report and the attention it will create may have the effect of helping on this desirable end. Forced draught and increased ventilation may do much, but other means are available, and it is perhaps not too high an estimate of the possibilities of engineering skill to point to the time when mechanical stoking, either altogether automatic, or at least superintended from a position on deck no less comfortable than that occupied by the ship's [illegible], will have taken the place of the present laborious, manual, and most hurtful, method deep down in the sweltering machinery hold of the steamship.

CAPTAIN NOBLE, as president of the Mechanical Science Section of the British Association, based his address upon the comparison of our old wooden navy of a century ago, by which England had obtained a title of "Mistress of the Seas," and our present iron-clad navy. He points out that the essential characteristics of the armament of such a line of battle ship as the *Victory* in the days of Trafalgar consisted of a large number of guns of comparatively small calibre, from the present point of view, and of still less proportional weight of powder, with many short barrelled pieces of small initial velocity, such as the carronades. The carriages were of timber, and the appliances for adjustment of elevation were wedges, all of a simple and rude description. These apparent defects, however, were counter-balanced by the pluck of our captains and crews in bringing the British ships always broadside to broadside with their enemies, so that the quicker and easier handling of the rude appliances was taken advantage of in rapid firing to the greatest possible extent. Large crews also were attached to each gun, as all the movements were effected by sheer manual power. With the introduction, however, of steam power into the navy, the carronades gradually disappeared, and the guns increased in calibre and weight of powder and projectile. Shell firing also was introduced about the time of the Crimean war, and was found to be most destructive in its effects. Now-a-days the armament has increased so enormously in weight of individual shots, and power of penetration, that it would probably be impracticable for any old-fashioned line-of-battle ships ever to get to sufficient close quarters with one of our ironclads to produce any effect at all with her light guns. Comparing the modern *Victoria* with the old *Victory* we find an increase of tonnage of nearly three times, and an increase of nearly double in length. The heaviest gun on board the *Victory* was a 42-pounder, a little over 3 tons in weight, whilst that on board the *Victoria* is a little over 110 tons. The largest charge of powder used on board the *Victory* was 10 pounds, the largest on board the *Victoria* is close on 1,000 pounds. The heaviest shot used in the *Victory* was 68 pounds, in the *Victoria* it is 1,800 pounds. The weight of metal discharged from the broadside of the *Victory* was 1,150 pounds, from that of the *Victoria* is 4,750 pounds. But the power of each ship is better indicated, having regard to the energy of the broadside, by the quantity of powder expended, than by the weight of metal discharged, and while the broadside from the *Victory* consumed only 355 pounds of powder, that from the

Victoria consumes 3,120 pounds. The comparison is also extremely striking between the *Victory*, which had not a single steam engine on board, and the *Victoria*, which has no less than 24 auxiliary steam engines in connection and together with her main engines. She has an addition of 30 steam engines unconnected with her propelling engine, and further, 32 hydraulic engines, making a total of 88 engines in all. This number is exclusive of the machines in torpedo and other steam boats, and of the locomotive engines carried in the torpedoes, which are themselves of the most refined and delicate character. The comparison is interesting in the concentration of steam power in the present torpedo boats and cruisers, as compared with the old wooden steam vessels. A first-class torpedo boat, as at present made, developes nearly the same horse-power as was considered sufficient for the old 90-gun line-of-battle ship such as the *Cæsar*, whilst the weight of engines and boilers producing a given horse-power has been reduced from some 300 tons to that of about 30. The consumption of coal per indicated horse-power has been reduced in almost an equal proportion. The consumption of coal in early battleships varied from 5 to 8 pounds per indicated horse-power per hour, whilst at the present time in good performances, and with a natural draught, an indicated horse-power is produced by 1¼ to 1¾ pounds. In a comparison also of the guns, we find the relative facts equally striking. The whole of the guns 35 years ago were made of cast-iron, with the smallest amount of machine work upon them, merely that of turning a smooth bore, and drilling a vent. Although this represented the acme of simplicity, they were far from free from liability to accident. It appears that of 317 guns employed in the siege of Sebastopol, no less than 8 had burst, 101 had been condemned as unserviceable,and 51 been destroyed by the enemy's fire. The 95 cwt. 68-pounder gun seemed to have been about the largest that could safely be made of cast iron, and it appears that the limit of safety had been nearly reached in this gun, as shown by the fact that a serious percentage of this size burst or otherwise failed. When spherical shot was in use, the weight of projectile per unit of area, which had to be set in motion, was however much smaller than in the modern cylindrical shot, and it is probable that to this circumstance the old cast-iron guns owed the comparative safety with which they were used. The introduction of rifling and elongated cylindrical shot necessitated an improved material for the gun-barrels. The experience of the U.S.A. in cast-iron has been extended into comparative modern times during the civil war there, and in a report upon their cast-iron guns it is in evidence that 10 guns flew to pieces probably by internal strains when lying on chocks, without having a shot fired from them, and 98 others cracked under like conditions. In the same summary it is stated that 147 burst in use, and 21 were condemned as unserviceable. During the action before Fort Fisher all the Parrott cast-iron guns in the fleet burst, and by the bursting of 5 of these guns during the first bombardment 45 men were killed and wounded, while only 11 men were killed and wounded by the enemy's fire. Captain Noble, after these interesting comparative statistics, concludes his address with a review of all that has been done under the increase of range and accuracy by rifling, the improvements introduced in steel to qualify it for gun making, and the improvement of explosives for obtaining a manifold increase of energy per pound of explosive, as compared with the old-fashioned powder.

EDINBURGH INTERNATIONAL EXHIBITION.

III.

In previous articles we have commented on the poverty of the Exhibition in the matter of exhibits representative of shipbuilding and marine engineering—branches of industry of the very first importance, and nowhere in the world so extensively carried on as within cry—so to speak—of the Exhibition. It has, however, been at the same time indicated that in one or two special lines shipbuilding is worthily illustrated, and that, as regards marine engineering, although exhibits are disappointingly few, this is partly compensated for by their interest and, in some cases, their novelty.

Messrs. Fleming & Ferguson's Exhibits.

The shipbuilding exhibits are grouped in the westernmost court, and consist chiefly of finely finished models and photos. Messrs. Fleming & Ferguson, shipbuilders and engineers, of Phœnix Works, Paisley, are well represented by a stand of great interest, consisting, as it does, of a collection of models and photos illustrating the varied class of work undertaken by the firm. The firm's specialities take such divergent lines as are implied in the production of powerful dredgers for rough utilitarian purposes, and swift graceful yachts for ministering to the pleasure of the affluent. A splendid example of the latter is shown in the form of a model of the *Imogen*, a 410-ton steam yacht recently completed for Mr. J. R. Wood, of Newcastle, New South Wales. This handsome craft is 184 ft. long, 24 ft. beam, 15 ft. deep, and is built of steel to Lloyd's highest class. She is most luxuriously appointed, having all modern improvements, including the electric light throughout. The engines—of 1,000 H P.—are of the builders' patent quadruple-expansion type, examples of which we have described and illustrated in former issues. These engines, it may be stated, have all four cylinders on one plane, making them very easy of access. The two cranks are not at right angles, but directly opposite each other, giving a perfectly balanced and smoothly working engine, specially suitable for yachts, where, as a rule, noise and vibration are serious objections. These engines have also the important advantages of taking up the minimum of fore-and-aft space, and effecting great economy of fuel. In dredgers the firm show a complete model of the hopper-dredger, built for the Barry Dock Co. at Cardiff, which is capable of raising 700 tons of spoil per hour from a depth of 33 ft., and her hoppers have a total capacity for 800 tons. A special feature in this vessel is the patent independent traversing gear with which she is fitted by her builders for the purpose of moving the bucket-ladder forward of the hull, thus enabling the vessel to cut in advance of the hull, and make her own flotation. They also show a model of the double-ladder dredger *Swansea*, to raise 1,000 tons per hour from a depth of 38 ft., and photo of one of their twin-screw self-propelling dredgers to raise 500 tons per hour, built for the late Mr. T. A. Walker in connection with the new harbour works at Buenos Ayres; also photo of one of three dredgers built for the Preston Corporation to raise 800 tons per hour; and photo of hopper-dredger, built for Anckland Harbour Board, to raise 500 tons per hour, and carry 600 tons. Other exhibits shown by the firm are models of the paddle-wheel tug *Mana*, built for the Timaru Harbour Board, and of an ordinary type of screw steamer, the *Singapore*

MESSRS. WM. SIMONS & CO.'S EXHIBITS.

Messrs. William Simons & Co., the well-known Renfrew firm, who have long made dredging plant a speciality, have an interesting display of models. Prominent amongst these is one of the hopper-dredger constructed for Belfast Harbour authorities. This vessel has a capacity to carry fully 850 tons and raise 600 tons of dredgings per hour. It is distinguished also by the firm's patent traversing bucket-ladder enabling the vessel to cut its own flotation through shoals and banks. An equally striking exhibit is the patent ferry steamer with elevating deck for embarking or landing vehicles and passengers on the same level as the quay, irrespective of the height of the tide, the deck or platform being raised or lowered to suit. The vessel illustrated by this model is now doing excellent service on the Clyde at Finnieston and elsewhere, in the present number we give plans and description of the vessel. A third exhibit on this stand is the model of the screw propelling dredger *Melbourne* built for the Melbourne Harbour Commissioners, and adapted for loading barges. It has capacity in its buckets for raising 1,000 tons of ordinary material per hour.

Messrs. Lobnitz & Co., Renfrew, are also exhibitors of dredging plant, models being shown of vessels completed by them for the Suez Canal Co., the Panama Canal Co., and the Mexico Drainage Canal. They also show ten half models of vessels they have built for various companies and services.

MESSRS. NAPIER, SHANKS & BELL'S EXHIBITS.

Messrs. Napier, Shanks & Bell, of Yoker, near Glasgow, exhibit two well-finished models as examples of the high-class work they undertake. One is the twin-screw steamer *Islander*, built in 1888 for the Canadian Pacific Navigation Co., of Victoria, British Columbia. This well-appointed passenger steamer, having large deckhouses and spacious promenade and shelter decks, is 240 ft. long, 42 ft. broad, and 14 ft. 8 in. deep, her tonnage being 1,500 tons. The engines, which were made by Messrs. Dunsmuir & Jackson, of Govan, have cylinders 20 in., 31 in., and 52 in. diameter, by 36 in. stroke, and 3,000 I.H.P. The mean speed over a series of measured mile runs was 16½ knots. The other is a model of the paddle steamer *Hygeia*, just completed for Messrs. Huddart, Parker & Co., Melbourne, at which port she is to engage in the passenger trade. This handsome paddle steamer—an account of whose trial appeared in the trial trip section of last issue—is 300 ft. in length, 32 ft. broad, and 12 ft. deep. Her engines, by Messrs. Rankin & Blackmore, Greenock, are of that well-known firm's patent disconnective triple-expansion type, having four cylinders 28 in., 28 in., 56 in. and 86 in. diameter, by 66 in. stroke, working tandem-wise on a double-throw crank shaft. She takes rank as one of the swiftest river steamers, having attained on the runs "between the lights" (Cloch and Cumbrae) the high average speed of 22·8 statute miles.

The Royal Mail Steam Packet Co., London, are exhibitors near here of a splendidly-finished full model of their steamship *Orinoco*, of 4,478 tons register, and 5,860 H.P., built by Messrs. Caird & Co., Greenock. This company also show a working sectional model made on the bachelor principle of the engines of this fine steamer.

MESSRS. STEEDMAN & McALISTER'S EXHIBITS.

Life-saving appliances are in evidence at the nicely-arranged stand—No. 526 west court—of Messrs. Steedman & M'Alister, Ardgowan Street, Glasgow. These comprise solid cork life-buoys made to Board of Trade requirements, to Admiralty, and to ordinary mercantile pattern; solid cork life buoy, of oval pattern (for cabins), and various sizes of yacht patterns. There is also conspicuously shown a solid cork life buoy cut in two, and one cut in sections to show the solidity of manufacture. Life-jackets and life belts to Board of Trade regulations, life belts to German and American regulations, life belts for fishermen and for passengers, life raft or buoyant cot-frame (Capt. Cressy's, R.N., patent), granulated cork mattress and pillow (which can be used as a life belt), are amongst the other exhibits shown.

MESSRS. BILLINGTON BRO'S. EXHIBITS.

At stall No. 309, near the machinery section, Messrs. Billington Bros., of Liverpool, show a variety of their specialities in ships, erths, folding and fixed, with patent spring bottoms, revolving aloon chairs with spring seats, also saloon seating into which the same elastic feature is skilfully introduced. An important feature in the construction of the berths is that the sides are formed of steel tubes and the ends of steel angles, and the tension bolts, which usually project beneath the wire fabric, are entirely hidden away within the tubes, thus avoiding injury to the fabric, protecting the screws from rust, and presenting a much neater article, the whole combining at once lightness in appearance with strength in construction. The firm's patent saloon seating has been fitted in many of the largest mail and passenger steamers, including the *Teutonic* and *Majestic* of the White Star fleet, and more recently several of the latest accessions to the fleet of the North German Lloyds. These seats are of a most elastic nature, being composed of longitudinal spiral springs running from end to end, supported at intervals on transverse springs of best cast steel.

MESSRS. HAWTHORNS & CO.'S EXHIBITS.

Messrs. Hawthorns & Co., Engine Works, Leith, at Stand 180 in the Machinery Hall, show Gallon & Chapman's patent hydraulic engine for working capstans or other machinery. The engine is shown driving a capstan. The cylinders oscillate on fixed studs, and are double-acting. The slide valves on the cylinder ends are governed by the cylinder's action, and have each one pressure and one exhaust port for half of the stroke, the other half being self-acting without valves. Another exhibit at this stand is Young's patent built crank shaft. The items shown are duplicate parts of the shaft fitted to the s.s. *Scotland*, of Christiania. The pieces shown are all that are necessary to be carried on board ship so as to replace any part of the shaft that might fail at sea.

MESSRS. CHADBURN & SON'S EXHIBITS.

Messrs. Chadburn & Son, the well-known telegraph makers, are well represented at Stall 39, where is to be seen Chadburn & Son's patent ship's electrical telegraphs, on which orders are indicated by illuminating the "desired signal" by incandescent lamps. They also show their engine automatic direction tell-tale, rudder automatic tell-tale, mechanical duplex gong telegraphs, engine telegraph with hand and automatic replies, steering telegraphs, engine direction and speed indicators showing the number of revolutions per minute, and Chadburn's patent engine counter.

MESSRS. FARGIE & CO.'S EXHIBITS.

Messrs. Fargie & Co., of 29, Shore, Leith, have an interesting display of apparatus and fittings connected with marine engineering and shipbuilding at their extensive stand, No. 19, in the machinery hall. Prominent amongst their exhibits are several examples of Quiggin's patent evaporators and condensers, as made by the Liverpool and London Condenser Co., of Brasenose Road, Liverpool, and already fully described in our July issue. Another noteworthy exhibit at this stand is a model of steam net and line fishing boats as built by Messrs. J. McKenzie & Co., Leith. The dimensions are:—Length, 70 ft.; breadth, 17 ft.; depth, 9 ft., built under Lloyd's rules and survey, and to the highest class. The engines are of the compound surface-condensing type, with cylinders 8½ in. and 16 in. by 12 in. stroke, supplied from steel multitubular boiler of 100 lbs. working pressure. The boats are also supplied with steam capstans for hauling in the herring nets. The engines have been designed in all their parts to combine simplicity, strength, and durability, and also to economise space and fuel. These fishing steamers have all been built to the order of owners in England, Ireland, and Scotland. Their independence of wind, tide, and almost of weather, is their main feature from a commercial point of view. As soon as their fish is on shore they are off again to the fishing grounds. Messrs. McKenzie & Co. were awarded a gold medal diploma for the model of these boats in the Edinburgh Exhibition of 1886. As agents for Messrs. Hunt & Mitton, Oozells Street-North, Birmingham, Messrs. Fargie & Co. also show fittings for locomotives, marine, stationary, portable, gas and other engines. They are of excellent manufacture, of good proportions, and strong materials. They are mounted on a framework, erected vertically, and present a mass of gun metal effectively displayed. Above are placed steam pressure vacuum and hydraulic gauges; below is a varied range of water gauges of various patterns and designs, trial cocks which are noticeable for their length of barrel and full clear ways, drain cocks, oil syphons, oil syphon box, wheel valves, gland and plug cocks, Storer's lubricators, cylinder grease cups, spring relief valves for cylinders, check valves, union joints for copper and iron piping. Below the main exhibit are some fittings, three and four way cocks, relief valves, throttle valves, and cast-iron cocks for chemical plant, especially heavy and well made. Killingbeck's patent sight-feed lubricator is shown in three sizes. The advantages are obvious—a perfect and visible feed which can be regulated to any desired amount. A specialty of Messrs. Hunt & Mitton are the copper seamless and frictionless expansion boxes for steam pipes. They have also a collection of cast-iron fittings, such as stop valves, chest valves, safety valves and cocks, all of good quality and workmanship; fire-brigade appliances and extinguishing apparatus, including the Tozer pump, which can pour ten gallons through a 5-16th jet, and by the aid of the upper air vessels maintain a continuous stream; stand and branch pipes and hose unions. These unions dispense with wiring the hose to the couplings. The exhibit conveys a general idea of Messrs. Hunt & Mitton's patterns, it being found impossible in a limited space to arrange a full assortment of the whole of their manufactures.

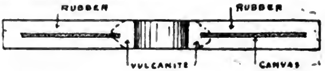
The Empire Co.'s Exhibits.

A noteworthy item connected with engine accessories is also to be seen at work in several of the principal driving engines in the machinery section in the shape of the sight-feed lubricator, manufactured by the Empire Co., of Bridgewater Street, Manchester. This company make a speciality of engine lubricators, and their "Empire" pattern is now in use on many of the largest steamships afloat, including the *America*, *Pavonia*, *Spain*, *Egypt*, &c., as well as on hundreds of large stationary driving engines throughout the world. One of the most noteworthy features of these lubricators—which are of superior construction and admirable finish—is regularity of feed. The feed is perfectly under control; once regulated, the lubricators can be left to themselves till empty, and will not vary. Their construction is such that it is almost impossible for them to get out of order. No plug-cocks or soldered joints are used, and all valves screwing right down on their seats, keep themselves tight. These lubricators are well worthy of inspection.

North British Rubber Co.'s Exhibits.

India-rubber—that curious and interesting substance whose properties, in the vulcanized state, so readily lend themselves to the purposes of the engineer—is magnificently to the front on the extensive stand of the North British Rubber Co., already incidentally alluded to in our previous articles. This company introduced the manufacture of vulcanized india-rubber into Scotland in 1856, erecting for that purpose the Castle Mills, a stupendous block of works at Fountainbridge, Edinburgh, and within eight minutes' walk of the exhibition. At the very outset they put down complete plant for the manufacture of all sorts of vulcanized india-rubber goods, both for mechanical, technical, and clothing purposes, and they have gone on increasing and improving their works and plant ever since, a recent and striking instance of this being the purchase of the complete battery of Galloway boilers at work in the exhibition. The company gives employment to 1,500 workpeople, and the capabilities of their manufactory are equal to the production of the finest tissue and the largest masses of india-rubber yet manufactured. The display made at their stand is one strikingly arranged and thoroughly representative, not only of the firm's varied finished articles in plain and vulcanized rubber, but of the processes of getting the raw coagulable milk from the india-rubber trees, preparing it for commercial purposes, and of putting it, in this form, through the several processes requisite for forming the multitude of articles in which it is the whole or main constituent.

Amongst the many patented articles which the company manufacture for mechanical purposes, and show at their stand, one of special interest to our readers is a new patent air pump valve for marine engines. A common defect of ordinary rubber valves is their liability to split at the centre, due in most cases to the imperfect mounting. To obviate this, all india-rubber valves should be loose at the centre, and should lift on the pump rod to the extent of their thickness at least. Another characteristic defect of rubber valves is that they slowly absorb any oil which may be contained in the water, and are thereby liable to become soft, and, on account of the heating action, to increase in diameter, so that trimming becomes necessary. When fitted with a dish-shaped guard also, circular rubber valves cannot lift equally so as to touch the guard all round its circumference. To make this clear, let us consider what takes place when a rubber valve lifts up to a dish-shaped guard. Suppose a point at any distance from the centre. When the valve lifts, this point will describe an arc of a circle till it touches the guard, and the distance of the point from the centre of the vertical axis will be diminished. It might now be taken for granted that, considering this diminished distance as the radius of an imaginary circle drawn upon the valve in its normal position, the radii at all other points on the circle would be the same—in other words, that the diminished radius would have a correspondingly diminished area of circle; but this is not the case, and it is due to the fact, often overlooked or not understood, that india-rubber is *incompressible*. Rubber valves so mounted, therefore, have necessarily unequal bearance round the circumference of the guard, and this is why such valves so readily split at the centre. The new patent valve has been specially designed to prevent the beating-out action. A vertical section of the valve (see above) shows a sheet of canvas inserted in the middle of the valve, and insulated from exposure to water at both outer and inner edges. The valve is formed of the best known preparation of india-rubber for resisting lubricant oils, and this feature, together with the presence of the canvas, effectively obviates the beating-out action so apt to take place under exposure to these oils. The centre of the valve is of hard vulcanite, and this holds the inner edge of the canvas, and permits the valve to slide easily on the pump rod. These new valves have now been under trial in steamships for over eight months, with results that indicate great durability. On examination lately, no signs of wear were apparent, and the original diameter had been exactly maintained.



Another patented speciality of direct interest to our readers shown by this large company is their spiralized piston-rod packing, which is so constructed that any length can be cut off, and is ready to fit into the gland without having to be bent or otherwise prepared. It will of course be understood that attention has only to be drawn to these items on this important stand which specially bear upon marine engineering; but no one can pay it a visit without being impressed with the multifarious and often ingenious adaptations of this interesting substance to articles used in all departments of manufacturing industry.

THE DOCKS OF GLASGOW.

THE annual inspection of the Clyde Harbour Works by the Clyde trustees and merchants and traders of Glasgow having taken place recently, a few particulars as to the past and probable future development of the harbour and docks of Glasgow may be read with interest.

One hundred years ago the revenue of the trust amounted to something like £2,000, whereas to-day it amounts to £355,000. It was not until comparatively recent times that the trust found occasion to have recourse to docks, and it was as late as 1867 that the first one was formed, viz., the Kingston Dock, on the south side of the harbour. Scarcely had this dock been opened before it was found necessary for the trustees to set about obtaining powers for the formation of another and still larger dock. The Queen's, or Stobcross dock, on the north side of the river, was the result; powers having been obtained for its construction in 1870. The work was begun in 1872, the first vessel was accommodated in 1877, and the last stone of the work was laid in 1880. The largest dock in Scotland, it comprises three basins of a total area of 33½ acres. In the very year in which the Queen's Dock was opened, the trust set about applying for powers for another and still larger dock. An Act of Parliament for the construction of this dock was obtained in 1883. In consequence of the commercial depression which followed, the project was not pushed; and this is now matter for satisfaction, because, had matters then been proceeded with, Glasgow would have been saddled with a dock imperfectly constructed and unfitted for the large ships now so common, without having a convenient site for forming a substitute. The Act for the construction of the new Cessnock Docks, now under way, was only finally secured this year, and the delay has again been beneficial, as the docks now being formed are in every way more perfect and suited to the present and probable future needs of the port of Glasgow. These docks comprise basins having a total water area of 38¼ acres, including entrance and connecting basin, and afford quayage to the extent of 3,786 lineal yards. Two new graving docks are also being formed alongside the present one, capable of accommodating the largest vessels afloat or ever likely to be built. One of these it is intended shall have a width at entrance of as much as 85 ft., a width not exceeded by any graving dock in the kingdom. This dimension has been adopted after communing with various people having a good knowledge of the future requirements of Glasgow harbour. Several eminent shipbuilding firms, credited with having a fair idea of what "the ship of the future" is likely to be, have advised that this width is no more than what will be required. Hitherto shipbuilders on the Clyde have been unable to take orders for repairs of large war-vessels, because they have not had the means either of docking them or of keeping them afloat. With the entrance now proposed very large and broad ships can be docked at the port of Glasgow. A similarly liberal policy has been followed in fixing the depth of the dock. This is as much as 26 ft. at high water, a great depth for the port of Glasgow, and one, possibly, difficult of obtaining. Notwithstanding this, it has been under consideration whether it would not be politic to give the dock a depth of 28 ft., and thus allow 2 ft. or so for the blocks upon which the ship rests when docked. In the case of many existing docks the depth is counted at a given amount, without subtracting for this necessary extra 2 ft. of depth; so that, practically, these docks can only be used for from 2 to 3 ft. less draught than they are reported as having depth for. As regards the length of dock, there is about 1,000 ft. available, and it is not likely that the actual length will fall short of this.

It would seem that the position of the Clyde Trustees has now come to be this: there is no further room in the port of Glasgow for making docks. The resources of science, however, are not exhausted. They have the electric light to fall back upon: work can be carried on for 24 hours a day. Double sheds can be made, one above the other, and so increase the accommodation of existing quays. Other plans may be resorted to for increasing the facilities for working the great trade which Glasgow may expect in the future; and, on the whole, it will, most likely, be a very long time before the present dock accommodation requires to be augmented.

WATER JET PROPULSION.

A MEETING of the Institute of Marine Engineers was held in the Langthorne Rooms, Stratford, on the evening of September 16th. The chair was occupied by Mr. G. W. Manuel, President, who introduced the subject of the evening in a few preliminary remarks and then called upon Mr. J. R. Ruthven to read a paper on "Water Jet Propulsion":—

Of all the great work carried out by the engineer, you will agree with me that the work of the marine engineer is the grandest, and carried out, from first to last, under the greatest difficulties.

With all our advance in design and workmanship, we are often painfully made aware of defects in our modern screw steamers.

One of the most serious is the feebleness of the power to stop a ship, and this in many cases is the cause of collisions.

Another defect is the difficulty of preventing, in some weathers, the racing of the engines, and thereby causing or leading to breakdowns sooner or later.

Another, and perhaps the most alarming accident that can take place in a modern ship is the breaking of the main shaft.

A broken shaft occurs so often, that one is driven to inquire the cause, when it is soon evident that the modern screw engine of great power, subject to quick reversals of motion, and to great variations of load, coupled with unknown bending strains, is eminently fitted to break shafts, no matter of what size or of what material.

The long shafting of the modern screw engine is a great source of trouble, chiefly from the movements of the hull; so much so, that the shafting may be said to be always bending, and this is one of the causes of broken shafts. At all times it is a source of anxiety to those in charge, especially in steel ships, which yield so readily to the strains to which they are subjected.

Here, then, we have the key-note to a great improvement.

We find that a land engine shaft, having a constant load, and moving in one direction, will run for a great number of years. Can this be done with a marine engine?

I propose to lay before you some of the properties of the Water Jet Propeller; a system of propulsion which promises to remedy most of the known defects.

It is not a novelty, indeed it is the first recorded method of propulsion after oars.

I may remark that the mode of propulsion of some of the oldest forms of marine creatures, the octopus, the cuttle-fish, and others, is by means of a jet of water forcibly discharged.

The Water Jet Propeller is a continuous jet of water, discharged in the opposite direction to that in which the ship is required to go.

There has been much confusion of ideas as to the fundamental nature of the Water Jet Propeller.

The performance of a rocket in its flight is perhaps the best illustration. Here we have an internal force producing motion by the unbalanced pressure of the explosive mixture.

This system of propulsion did not attract attention until it was applied by means of a pump which gave a continuous jet: and this was first done by my father and grandfather over fifty years ago.

In marine propulsion our first object should be safety; second, comfort; third, speed; and fourth, economy. I place safety first, as few will dispute the value of life.

Here we have a propeller, powerful in stopping a ship, powerful in pumping out water accumulating from a leak, able to steer the ship without a rudder, a propeller that cannot race, one that can put out any fire, and one that cannot be fouled.

The power to avoid collision, by sudden stoppage and reversal of the ship's headway, is a power of chief importance. This power has been often proved with the water jet. With higher speed it becomes more important. Even in foggy weather a vessel might safely travel when the officer could see a ship's length ahead. In passing I may remark that the great stopping power is a proof of the efficiency of the water jet as a propeller. I need not point out the value of quickly stopping and backing in the case of a man overboard; while, with the great power of turning, there will be very little danger through loss of steerage way. For quickly stopping and reversing the motion of a ship fitted with the water jet, reversing the discharge of the jets is all that is required; and I have seen a ship propelled by the water jet brought to rest from full speed in her own length.

The ship can be propelled astern with the same force as ahead; this is not the case with the screw. Great speed, without the power of stopping quickly, is simply courting disaster.

Human eyesight and judgment have comparatively narrow limits; and if the largest ship at the highest possible speed cannot be stopped to order in less than 1,000 feet, we are liable any day to hear of a great wreck.

Many good ships have been lost by collision, and probably this has been the fate of many that have not been heard of.

An iceberg, a water-logged ship, or other heavy obstacle, must prove fatal in many cases. And when we consider that the most appalling wreck is yet in the future, if we continue to go fast without the power of quickly stopping, this point becomes one of constantly increasing importance.

Our common road carriages and railway trains are all now fitted with means of quickly stopping. How much more important is it at sea! where the freights are larger and more valuable, as to the human and the material respectively.

With such a power on board a ship, all voyages would be more rapid, for the delays due to caution are considerable. Our quick train service is greatly due to the break-power.

In the water jet we have a propeller which is also a means of pumping out the ship and propelling her at the same time.

The necessity for a bilge pump on board ship is so evident, and the necessity for a powerful one is also so evident, that I am surprised that it is not yet compulsory to apply more power to pump out the bilges when occasion requires.

With the jet propeller the pumping power is the whole power of the engines, and may be at the rate of 2,000 tons per minute; 120,000 tons per hour or more.

There have been cases where a ship is said to have sunk in a few minutes after a hole has been made in her plates.

It is quite possible, with the Water Jet Propeller, to arrange to keep a ship afloat, which would otherwise sink in five minutes. And not only float, but to propel her on her voyage; so that she would be safe, although leaking continually.

The power to stop quickly, and the power to pump out a large quantity of water should be compulsory in all steamships. Make the ship safe, that is the best life-saving apparatus.

With the Water Jet Propeller the ship can be navigated in the case of a damaged rudder.

In the going astern there is no difficulty, as often occurs with a screw-ship. Again, no screw aperture being necessary near the rudder, steering by the rudder is much more certain and effective.

As regards turning, I have seen a ship, fitted with the water jet, turn on her centre; that is, in her own length. The quickest way and smallest space was by using one jet ahead and the other neutral.

The power to turn without going ahead or astern is valuable in some cases.

The movements required to control the disharge of the jets may be made from the deck, or from the engine-room, or gear may be fitted in both places.

The discharge of the water, both above and below the water-line has been tried, and the effect was practically the same Hence, rolling and pitching will have little or no effect, and there can be no racing due to the position of the discharge pipes, relative to the surface of the water.

So long as the bottom of the ship, amidships, is in the water, so long will the pump draw, and send out a continuous stream of water with a practically constant flow, and so have a practically constant propelling effect.

In the case of fire—one of the chief terrors at sea—the enormous quantity of water that can at once flood any part of the ship must put out any fire.

In the case of obstructions to the screw propeller, of floating wreckage, ropes, timber, or other obstacles, the value of the water jets stands out in great contrast to any propeller having a moving part outside the ship.

With the Water Jet Propeller there is no vibration. For high speeds this is of great value, not only to the comfort of the engineers and passengers, but the life of the engines and ship will be longer.

Regarding speed, there can be no limits except the power which the ship can carry.

For use with sails the water jet is most perfect, as full use of the sails can be taken, while the water jet is independently doing its work. The two modes of propulsion do not interfere with each other, as they undoubtedly do in the case of the screw.

In a head wind the loss of the screw is great; with the water jet the loss is much less, the force on the ship being greater the slower she goes.

In towing, the pull is greater for same I.H.P., so that in the case of a vessel on a sand-bank, she could more easily get off than with the screw. The power of quickly stopping proves this.

With the Water Jet Propeller the speed of the ship may be varied, and the direction, ahead or astern, or turning to port or starboard, may be effected with one continuous speed of engine.

There is no heavy stern frame required, so that the shipbuilder will have some saving in cost, and the ship relieved from the heavy weights astern.

By taking away the screw aperture the ship may be made that much shorter, or have greater displacement, and with the same fineness of lines aft.

With regard to the exact economy in smooth water as a propeller, the trials hitherto, in some cases, gave results superior to the screw, in other cases below the screw. But taking all the evidence on the best authority I know on this subject, I am convinced that in smooth water the economy of the jet propeller will probably be 30 per cent. above the screw, while in some cases at sea it may be 50 per cent. above the screw.

As so much success has been attained in the few trials already made, I look for a grand future, both as regards economy and every other advantage claimed or proved.

With regard to first cost, and relative weights, I am of opinion that the weights will be about equal to the screw propeller; that is, the total weights required by the screw propeller will about equal the displacement due to the Water Jet Propeller. The cost will settle itself, and eventually may be no greater than the screw.

The largest power applied to this system was in a gunboat 160 ft. long, 32 ft. beam, of 1,300 tons displacement, I.H.P. 750, discharging 350 tons of water per minute, and the speed was 10 knots an hour. In this case two jets, each of 2 ft. diameter, were used.

The size of the discharge tubes has been the subject of great difference of opinion. One engineer recommended two jets each of 5 ft. diameter, for a ship which was successfully driven by two jets of 2 ft. diameter. Another experimenter has gone to the opposite extreme, and proposed very small jets. As you know, there is a medium in all things, and somewhere between the extremes will be found the best proportion.

For the largest ship I would have jets under 2 ft. diameter, and have a number of them placed where convenient. The revolutions of the pump may be anything thought best, say from 50 to 200 per minute. It is most convenient to have at least two jets, and to arrange them one on each side of the hull, near the 'midships. The two jets may be supplied from one pump, or from two pumps. For large power I would have two or more jets at each side, and each jet to have a separate pump, and each pump to have its own separate set of engines. By the subdivision of the propelling power into two or more entirely independent sets of apparatus, there is hardly any conceivable accident which could happen, that would seriously affect the safety or propulsion of the ship.

The engines may be placed ahead or astern, or both ahead and astern of the main hold, so that, with a light ship, the trim would still be maintained.

A special form of ship is not required, the cargo may be stowed where thought best, and not cut up, as by the tunnel.

Whatever the popular opinion may be, I am satisfied of the great value of this propeller, and therefore bring it to your notice, and point out to you some of the more important advantages, which have been proved, or are self-evident, and I believe a number more will develop themselves when further trials are made, and more particularly will the value appear when at sea in the very circumstances when the greatest loss comes to the screw propeller. At the very time when the full power is wanted, the screw is at a disadvantage, whereas with the water jet, all the circumstances of the ship at sea are practically indifferent to it.

The jet propeller is a subject that insurers of ships should look carefully into; but I leave them to look after their business, and am only desirous that we should fully discuss the subject from our point of view, that is, as engineers, both designers and sea-going—for it is a matter of life or death when the critical moment comes.

I am often distressed when I hear of a ship sinking for want of pumping power, and shocked that a vessel, otherwise good, but nearly full of water, with boilers and engines intact, gives the crew no alternative but to leave her in mid-ocean, and trust to a few poor boats.

The screw propeller to-day has perhaps reached its limit of perfection; while, with all its success, there must still be opportunities for improvements in the water jet, so that its possibilities are greater than we know of.

If we compare the modes of action of the jet and the screw, we will see that every particle of water used by the jet is discharged in one direction, while with the screw there is a complex action, discharging water radially by centrifugal force, and many particles driven at various angles from the direction required. With the jet the contrifugal motion is used with full effect—with the screw it is entirely lost. Again, compare the water friction; the screw has surfaces moving twice the speed of the surfaces in the Water Jet Propeller, this gives four times the loss for the screw, compared with the jet, surface for surface. Again, a well-known fact, is the increased resistance of the ship, entirely due to the action of the screw.

I believe this is the first time that the subject of water jet propulsion has been laid before those chiefly concerned. If you approve, or even wish that such an apparatus may be put into your hands, and resolve to make it a success in every way, I have no doubt it will be done. Hitherto, no one has cared to look into the matter with sufficient interest, and it has long ago been cause of wonder that so many good qualities have been neglected.

The Water Jet Propeller should be used, if only for the great pumping power. Had it no other advantage except its stopping power to avoid collisions, it is of immense value; but when it has so many advantages, it is our duty to ourselves and others to go thoroughly into the subject, and make the best we can of such a simple marine propeller.

False theories must not be allowed to obstruct the way to such a number of good qualities. The power of practical men gave us ocean steam navigation, in opposition to false theories; that is a well known instance, and there are a number of others.

It is surprising that so little has been done in this system of propulsion, yet quite a number of engineers have experimented with this propeller; but few have had the courage to try more than one or two examples, had they only stuck to it they were bound to succeed.

With comparatively light cranks, no propeller shafting, no tunnel, no unknown strains, no moving parts outside the ship, no racing, no vibration, no reversing, no easing, no priming, and no breakdowns, I look forward to a time when sea-going engineers may have more comfort and greater safety.

After reading his paper, Mr. Ruthven gave some interesting data, gained from experiments made in past years with steamers fitted for water propulsion.

Reference was made to the recent trials on the Thames of the life-boat built by Messrs. R. & H. Green, and engined by Messrs. Thornycroft.

The Honorary Secretary announced that a meeting was being held in Cardiff, where it had been arranged that Mr. Ruthven's paper would be read and discussed simultaneously with the arrangement in Stratford; in this, their first ventnre, the Cardiff members were wished all success in their effort.

The discussion was then entered into by Messrs. F. W. Wymer, J. D. Bisset, J. A. Rowe, F. W. Shorey, G. W. Manuel, and others, when some interesting points were touched upon, both favourable and unfavourable to the system advocated by the author of the paper. It was urged that if Mr. Ruthven could design a set of machinery to suit a large steamer, it would be invaluable for reference and discussion purposes.

The meeting was brought to a close by the usual vote of thanks to the author of the paper, which the Chairman proposed, and which was seconded by Messrs. Simpson, Baker, Dibb, and Shepherd.

Improvement of the River Ribble.—Messrs. Wm. Simons & Co., Renfrew, have received an order from the Corporation of Preston for the construction of three steam hopper-barges for the improvement of the River Ribble.

The s.s. *Talune*, 1,991 tons, lately built by Messrs. Ramage & Ferguson, for the Tasmanian Steam Navigation Co., has ived at Hobart Town, Tasmania, after a rapid passage of 48 s, from Leith.

AN UNPRECEDENTED RECORD.

THE "BRITANNIC."

We have on previous occasions drawn attention to the singular performances of many of the White Star Company's vessels. We say "singular" because the results attained are absolutely without parallel in the history of steam shipping. We could mention many fine ocean steamers belonging to the various companies which still do good work after some ten or fifteen years' service, but it is always the case that such vessels are relegated to the less important routes owing to their inability to maintain the requisite speed. In fact, taking the average experience with ocean steamers, it is found that in ten or twelve years' time they become obsolete and it is then usually a question of re-engineering and reboilering them, or selling them out of the fleet. Looked at, then, in the light of the average steamship capability, the record of some of the earlier White Star Company's vessels is simply marvellous, and, as we say, altogether without precedent. We have before us the log of the White Star mail steamer *Britannic*, which arrived in the Mersey on Thursday evening, 4th Sept., from New York. She left New York at 9.35 p.m. (Greenwich mean time) on Wednesday, August 27th, and arrived at Queenstown at 4.30 a.m. on Thursday, the 4th Sept., thus completing her 318th Transatlantic passage in 7 days, 6 hours, 55 minutes, the fastest time she has yet made. The following is her log:—

August	28 ..	.. 292	knots.
,,	29 ..	.. 372	,,
,,	30 ..	.. 377	,,
,,	31 ..	.. 370	,,
Sept.	1 ..	.. 376	,,
,,	2 ..	.. 377	,,
,,	3 ..	.. 387	,,
—	— ..	.. 261	,, to Queenstown.
	Total..	2,812	knots,

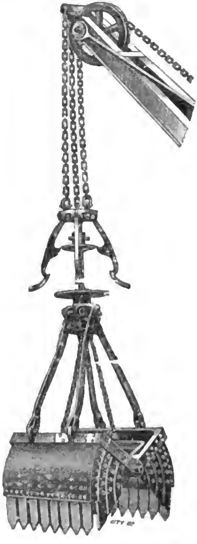
or an average speed of 16·08 knots per hour. Fine weather prevailed during the passage. The *Britannic's* previous best performance was in March, 1883, when she crossed from Sandy Hook to Queenstown in 7 days 9 hours 30 minutes, which was regarded as sufficiently remarkable. But when it is remembered that this high speed, averaging over 16 knots per hour throughout, or nearly 19 statute miles, is obtained in a ship of over 16 years old, with her original compound engines and boilers, on a small coal consumption, and with her large carrying capacity, it will be seen that the *Britannic* has been so constructed as to give results unattainable with the fastest ships of the present day, and actually increases in speed as she grows older, reversing the usual experience. It is worthy of mention that in ten voyages performed during 1888 the *Britannic* averaged 7 days 15 hours 57 minutes, while her sister ship, the *Germanic*, during 1889 made thirteen voyages averaging 7 days 15 hours 21 minutes, showing a wonderful uniformity in the speed of these twin vessels. The *Britannic* and *Germanic* were built in 1874, by Messrs. Harland & Wolff, Belfast, and engined by Messrs. Maudslay, Sons & Field, London, the engines being a remarkably fine set of Tandem compounds. The question may be asked to what do we attribute the magnificent performances of these vessels? We can only say that, in our opinion, a very great deal is to be credited to the shape of the hull. When any of our great liners are in dry dock we make it a point to inspect them, and compare the different lines. Anyone who has done this, and compared the *Britannic* with other crack boats, cannot have failed to notice very great differences. The extreme fineness of entrance, the absence of forefoot, the long and full midship section, and the graceful run aft are features of these boats more pronounced than in most others. Again, a glance at the proportions of these boats and the results achieved prove the soundness of Scott-Russell's theory that to obtain speed we must have great relative length. These points in the design of the hull have been so carefully and judiciously considered by the talented designer of the White Star boats, Sir E. Harland, with the result that they are among the most economical as regards coal consumption of any vessels on the Atlantic. Of course we can put, as is sometimes done, unlimited power into a vessel and drive her. This is, however, not scientific, and therefore not commercially successful. In the machinery of these vessels there is nothing very special except that at the date of its construction it represented the best marine practice. Those who believe in "good iron" for ships and engines can certainly point to the *Germanic* and *Britannic* as an instance in point. Another very important factor has been the splendid workmanship put into these vessels, and another equally important factor is that the owners have a name for keeping their vessels in the highest state of efficiency, no expense being spared to this end. Lastly, Messrs. Ismay, Imrie & Co. entrust their splendid vessels only to the very best men, as captains, engineers, and officers, that they can procure. Nothing except faithful service rendered, work honestly and carefully performed, could achieve these astonishing results. The company pay the highest wages, and so obtain the best service. The *Britannic* is commanded by Captain Henry Davison, R.N.R., who served his apprenticeship with Messrs. Ismay, Imrie & Co., has continued throughout in their employ in sail and steam, and was the captain of one of the White Star steamers in the Pacific trade for several years before obtaining his command in the Atlantic service. The chief-engineer of the *Britannic*, Mr. Kitchen, has also a very creditable record. Before being promoted to the *Britannic* in August, 1888, Mr. Kitchen was for 16 years in charge of the *Adriatic's* engines, and during that time made 154 round voyages between Liverpool and New York, nearly a million nautical miles, without having any disablement in his engine-room. It gives us peculiar pleasure to place the above facts on record. Not only from the technical point of view, but also from a higher standpoint, the performances of the *Britannic* reflect a lustre on all concerned.—*Liverpool Journal of Commerce.*

NEW TRANSATLANTIC TRADE ROUTE.

WE are able to state that a powerful syndicate has been formed for the purpose of taking steps to open up a new route between England and America. The name of the syndicate is the North Canadian Atlantic Railway and Steamship Syndicate (Limited), its chairman being the Right Hon. Sir Henry A. Isaacs, Lord Mayor of London. With him in the directorate are Sir R. N. Fowler, M.P., Mr. Thomas Wood (chairman, Milford Docks Co.), Mr. Charles G. Mott (director of the Great Western Railway Co.), and Mr. William Ralston Bolch. The capital of the syndicate, which has been duly formed and incorporated, is £50,000. This, of course, is for the preliminary stages only. When the company is formed they will acquire a capital computed at £4,000,000, with which railways, docks, and steamships will be constructed and operated. Briefly described, the scheme is to construct a line of railway between Quebec and a point on the extreme east of the Labrador coast, presumably St. Charles's Bay, from whence steamers of 20 knots speed can readily accomplish the voyage to Milford Haven in 94 hours. As the distance from St. Charles's Bay to Milford is only 1,870 miles, as against 3,070 from New York to Liverpool, the saving accomplished on the new route by a 20-knot steamer will be some 60 hours. On the English side the Great Western Railway Co. have expressed their readiness to spare no expense in making the new route a success, and on the American side it will form a direct and straight line from the great West of the United States and Chicago to England. Taking the distance, from Chicago, *via* the Grand Trunk and North Canadian Atlantic railways to the Straits of Belle Isle, the railway journey would be 1,870 miles, which, at the rate of 40 miles an hour, need not take more than 47 hours. This, plus the 1,870 miles of sea voyage to Milford Haven at 20 knots, would make a total of 141 hours, or 5 days 21 hours, whilst the same journey from Chicago, *via* the Pennsylvania railroad to New York, 936 miles, at 40 miles per hour, will take 23½ hours, which, plus 3,070 knots of sea voyage at 20 knots, makes a total of 177½ hours, or 7 days 9½ hours. The proposed new route *via* St. Charles's Bay would therefore represent an actual saving of two days and a half of uncomfortable sea passage, and would enable passengers to reach Chicago or England about two days sooner than at the present time. The railway portion of the scheme is not the least important, and the initial difficulties in regard to this have already been got over. Charters of Parliamentary powers have been granted by the Canadian and Newfoundland Governments, the latter giving to the company, free of any charge, land for the railway (where it runs over Crown land) to the extent of 100 feet on each side of the track, and also for stations, workshops, and other purposes necessary for the operation of the road. The Canadian Government have on their part given power to acquire the Quebec, Montmorency, and Charlevoix Railway, and until such acquisition is accomplished running powers are granted. These valuable concessions having been secured, an expedition has been organised, and towards the end of last month set out on a survey for the location of the line.

A SINGLE-CHAIN GRAB.

MESSRS. JOHN H. WILSON & Co., of Bankhall Engine Works, Sandhills, Liverpool, have recently introduced an improvement in grabs for dock and other excavating works. Of this we gave a few details in our "Mersey Notes" a month or two back, but the accompanying illustration, with additional particulars, will be interesting to our readers. The main features of this grab, which is Price's patent, are, as will be seen from the illustration, that, whilst being worked with a single chain, the ordinary barrel for opening and closing the jaws of the grab is entirely dispensed with, this being effected by means of levers or arms, the whole of the grab being thus left clear for the work it has to do. The advantages claimed for the Price's single-chain dredger are that it can be applied to any ordinary crane and worked by one man only; the dredging can be done to any depth, and it is perfectly automatic in all its actions, whilst it is certainly one



of the most simple and reliable grabs in use, besides being more durable and less in first cost. The engraving shows one of these plate buckets for excavating hard sand or earth. These dredger buckets are made in four standard sizes, viz.:—Quarter, half, three-quarters, and one yard. Half-a-dozen of these grabs are at present in operation on the Manchester Ship Canal, and the approximate capabilities of the machines in ten hours' work are as follows .—

	¼ cubic yd.	½ cubic yd.	¾ cubic yd.	1 cubic yd.
Excavating clay ..	150 tons ..	300 tons ..	400 tons ..	500 tons
Mud dredging	300 ,, ..	550 ,, ..	700 ,, ..	850 ,,
Size of crane......	1 ton ..	2 ,, ..	3 ,, ..	5 ,,

SEA WATER FOR MARINE BOILERS.

IN the old form of marine boilers working at low pressures sea water was almost entirely used, and although considerable incrustation was the result, causing waste of fuel and deterioration of the boiler, still it was considered better to put up with this than to face the expense of supplying the boilers with fresh or distilled water; but with the introduction of high-pressure tubular boilers the amount of deposit formed was so serious, and the difficulty of cleaning out the deposit from between the tubes so great, that it became almost imperative to discontinue the use of sea water rather than to risk the burning and destruction of the tubes and plates in inaccessible portions of the boiler, which could only be removed when time could be spared for a complete clean out and refit.

In 1889 Professor Lewes, of the Royal Naval College at Greenwich, read a paper at the Institution of Naval Architects which created a considerable amount of interest, and in which he traced the formation of the various kinds of boiler deposit, and pointed out that it was possible to so prepare sea water that it should give no incrustation unless evaporated to a density at which the salt itself would crystallise out; and, having devised an apparatus for this purpose, Mr. J. H. Biles, the general manager of the Naval Construction Works, Southampton, determined to try the process in a boiler working a crane on one of the jetties in his yard, in order to practically determine if the method would give the results claimed for it. The boiler was kept under steam for a month, using nothing but prepared sea water, and blowing off the steam when it was not required for other purposes, and was opened on Wednesday, September 10th, in the presence of a representative gathering of gentlemen interested in the subject, including Mr. W. H. Riley, R.N., present on behalf of the Admiralty, Mr. J. T. Milton, representing Lloyd's Register, Mr. Dusantoy, representing the Union Co., Mr. Biles, Mr. Gearing, Mr. Archibald Thomson, and Professor Lewes, and it was found that the result was in every way eminently satisfactory, the interior of the boiler being in perfect order and free from any trace of incrustation or scale, the plates merely looking as though they had received the thinnest possible brush over of whitewash.

The water used in this experiment was drawn from the Itchen a short period before high tide, and enough was stored in a large tank to last for the day's consumption, and on analysis this water proved to be practically sea water contaminated with sewage, and containing a large proportion of suspended earthy matter, which, under ordinary circumstances, would have given an extremely heavy incrustation. The water was pumped a ton at a time into the precipitating vessel, which consists of an egg-shaped boiler placed on end, with a small man-hole at top for the introduction of the precipitating materials, and fitted below with blow-off cock, a tube to lead away prepared water, and a pipe through which steam can be blown into the contents of the boiler, or "precipitator," as it is called.

The water having been introduced, exhaust steam is blown into it until the boiling point is reached, and the "precipitator powder," made up in packets of the right size, is then introduced through the small man-hole, and entering into solution in the water, at once throws down all the lime and magnesium salts which are present, in the form of a white flocculent precipitate. The action, however, is not yet quite completed, and the precipitate is not dense enough to settle rapidly; these points being attained by closing the man-hole and blowing in steam until a pressure of 10 lbs. is obtained in the precipitating vessel, and if this pressure is maintained for a short period the precipitate becomes very dense and rapidly settles, merely leaving a slight turbidity, which is got rid of by running the prepared water through asbestos cloth in a filter-box. The water so treated contains nothing but sodium salts, which, being excessively soluble, will not form any deposit until sufficiently saturated for the salt itself to crystallise out, a point which is only reached when the density has become over 1·2, or 7·32 on the salinometer.

The advantages of the prepared water for use in marine boilers are, in the first place, cheapness, as the preparation only costs 1s. to 1s. 2d. a ton, or less than is paid at many ports for ordinary fresh water, and far less than distilled water can be made at by any process. Secondly, it saves the carriage of either considerable quantities of fresh water or else of complicated distilling plant, whilst it is preferable to distilled water, the solvent action of which upon metals is a distinct drawback. Thirdly, it not only does away with all incrustation, but, by also removing the magnesium salts present in the water, prevents pitting, and does away with the necessity for zinc in the boiler, and, finally—the density of the prepared water being less than that of sea water, and it being possible to evaporate off a much larger proportion of it—the loss of heat, by blowing off, is very small, and as the exhaust steam used for heating the sea water is all condensed and passes back with the prepared water, which is at the boiling point, to the hot well, loss of heat is also here avoided.

EXPRESS TRAINS IN CONNECTION WITH OCEAN PASSENGER STEAMSHIPS.

II.

The Great-Western Railway Company.

PLYMOUTH and Dartmouth are the ports in which the Great Western Railway Company are particularly interested as regards the subject of this article.

The ocean steamers embarking passengers from the former port are (*a*) those of the Oriental line, fortnightly, for Gibraltar, Naples, Port Said, Suez, Columbo, Albany, Adelaide, Melbourne, and Sydney; (*b*) the steamers of the New Zealand Shipping Co., monthly, to Tasmania and New Zealand; (*c*) the Shaw, Savill, and Albion Co.'s ships, monthly, to the same destination. Among the more important steamers which take passengers at Dartmouth are the Castle Mail Packet Co.'s liners which leave there fortnightly for Capetown and other parts of South Africa.

The ocean steamers that stop at Plymouth to land passengers are (*a*) the Orient liners from Sydney, Melbourne, Adelaide, Naples and Gibraltar fortnightly; (*b*) the New Zealand Shipping Co.'s and the Shaw, Savill, & Albion Co.'s ships monthly from New Zealand, Rio de Janeiro and Teneriffe; (*c*) the Royal Mail liners from the West Indies fortnightly; (*d*) the P. & O. steamers from Australia, Ceylon and Brindisi fortnightly; (*e*) the same company's ships from China, Bombay, and Brindisi fortnightly; (*f*) the same company's liners from Calcutta and Marseilles fortnightly; (*g*) the Castle Mail Packet Co.'s steamers from Cape Town and Madeira monthly, and from Cape Town and Lisbon monthly; (*h*) the British India Steamship Co.'s liners from Queenstown monthly, and from Calcutta at irregular intervals; (*i*) the Pacific Steam Navigation Co.'s ships from the Pacific Coast and Rio de Janeiro monthly.

As no certain hours are fixed by the before-mentioned shipping companies for their steamers to arrive at or depart from Plymouth the Great Western Railway Co. do not run any special train to that port in connection with such steamers. Special express trains however, often convey voyagers landing at Plymouth to London by nearly all the ocean liners referred to which land their passengers at the former place. The Great Western Railway Co. have some excellent express trains running between Paddington and Plymouth, much to the appreciable convenience of intended voyagers from this western port whose time is thereby economised.

The best of these trains are the 10.15 a.m., which arrives at Plymouth at 3.50 p.m. after stopping at Swindon, Bristol, and Exeter only. The 3 p.m. is also another very fast train. It arrives at Plymouth at 8.55. The 5 p.m. express reaching Plymouth at 12.10 a.m., is also much to be commended for oceanic steamship passengers' purposes. As regards fast up-trains the 2.10 from Plymouth, which reaches London at 7.50, and the 8.23 p.m., which arrives at Paddington at 4 o'clock on the following morning, are very fast and comfortable trains. The latter is provided with a first-class sleeping carriage from Plymouth to London.

Very good through communication also exists between the North and Plymouth, *viâ* the Severn Tunnel. Trains leaving Edinburgh at 10.15 a.m., and Glasgow at 10 a.m., Liverpool at 3 p.m., and Manchester at 3.5 p.m., get to Plymouth at six minutes past midnight. Passengers leaving Edinburgh at 6, Glasgow at 5.50, Liverpool at 11.45, and Manchester at 12 p.m., reach Plymouth at 10.50 the next morning. Through trains are run on this service from Liverpool and Manchester to Bristol by each train, and from Glasgow to Bristol at 10 a.m., and 5.50 p.m. from Plymouth to the North. The 8.35 a.m. express reaches Manchester at 5.10, and Liverpool at 5 20 p.m. The 11.50 a.m. from Plymouth arrives at Manchester at 8.40, and at Liverpool at 8.50 p.m. A third fast train leaves Plymouth at 2.30, which gets to Manchester at 12.20, and to Liverpool at 12.25 the following morning. Through carriages are attached from Bristol to Manchester and Liverpool by all trains, and by the 9.30 a.m. and the 7.30 p.m. trains from Bristol to Glasgow.

The Great Western Railway Co., with the view to the greater convenience of passengers landing from the mail steamers at Plymouth, and proceeding thence by the Great Western Railway, have arranged that railway tickets can be obtained at the ticket office of the company at the baggage warehouse in the Great Western Docks, situated about 600 yards from the railway station at Millbay. The fares cover the dock toll and all services rendered in connection with the conveyance of passengers' baggage to the baggage warehouse, its examination there, and its conveyance to the Millbay Station. The tickets from Plymouth to London are available for seven days from the date of issue, and passengers booking to London by the Great Western Railway may break their journey at any main line station *en route* if the journey is completed within that time. The necessary authority to break the journey must be made to the ticket clerk at the docks, or to the stationmaster at the Millbay Station.

A special fast train called the "Castle Line" express train leaves Paddington at 8.55 a.m. on each alternate Friday for Dartmouth, which it reaches at 2 p.m., in connection with the Castle Mail Packet Co.'s steamers, which start from that port an hour later.

According to arrangements made by the company, passengers who join the steamers at Dartmouth are granted free railway tickets from Paddington to that port by the Castle Express, while passengers proceeding from the West of England are given free railway tickets from Plymouth to Dartmouth for the mail steamers, and from Plymouth to London by the intermediate steamers, on which they can embark at London or at Flushing. Free railway tickets are also granted to homeward passengers landing at Plymouth from that place to London. For the convenience of passengers from the West of England a through carriage, 1st, 2nd, and 3rd class, is attached on every alternate Friday in connection with the steamers from Dartmouth to the train leaving Penzance at 6.25 a.m., and which intending voyagers can join at the intermediate stations.

Friends who wish to see passengers off from Dartmouth are granted return tickets between Paddington and that port at the reduced rates of 45s. first-class, 30s. second-class, and 20s. third-class. These tickets are, however, only available for the journey to Dartmouth by the "Castle Express," and the return journey to London by any ordinary train carrying passengers of the class for which tickets are held, up to and including the following Monday. A special early breakfast is provided on these Friday mornings at the Great Western Hotel, Paddington.

Reduced third-class railway fares from Liverpool, Manchester, Edinburgh, Glasgow, Hull, and some of the other leading towns in the United Kingdom are allowed to third-class voyagers by the Castle Line steamers on the presentation of vouchers which are issued by the company, and the railway companies allow these passengers an extra quantity of baggage free.

LONDON AND NORTH-WESTERN RAILWAY COMPANY.

This company, in addition to the advantage of having many trains which proceed to Liverpool in about 4½ to 4¾ hours from London, runs a special express from thence to Lime Street Station, Liverpool, in connection with every steamer leaving there for the United States and Canada. A fast train is also specially appointed to run from Paris *viâ* Calais and Dover, in connection with these special trains. Numerous special express trains are also run from Liverpool to London conveying passengers who land from the United States and Canada.

The steamers which leave Liverpool for the United States include those of the White Star, Inman and International, Cunard, Guion, Anchor, National and American Lines, while the ships despatched from this port to Canada include the Allan, Dominion, and Beaver Liners.

Passengers who do not wish to leave London until the last moment can save one day on the Liverpool route by starting from Euston Station, London, by the Irish mail train at 8.30 p.m. in the evening of the day of departure of steamers from Liverpool, and travelling *viâ* Holyhead, Kingston, and Dublin to Queenstown or Londonderry (Moville). At Queenstown and Moville passengers and mails are taken on board the mail steamers which left Liverpool the previous day. Time can also be greatly economised by this route by passengers from Manchester, Liverpool, Birmingham, Bristol, and other large centres of population. When the mails are landed at Kingston they are sent on to Dublin by a special train running a few minutes in advance of the ordinary morning train, to which is attached a carriage for passengers booked through to Queenstown and Londonderry, but only such baggage as they can take with them in the carriage is allowed, as there is no baggage car. Baggage is only labelled as far as Dublin Westland Row Station, where passengers must claim it and take it by cab at their own expense and cross Dublin to Kingsbridge and Amiens Street Stations, at which they should have it relabelled to Queenstown or Londonderry.

Personal effects for passengers' own use are only checked as baggage. Other goods and articles are carried as merchandise. The baggage of passengers going to America who have taken London and North-Western Railway tickets from London to Liverpool, Queenstown or Londonderry, can be checked on two systems, namely, by the method of the London and North-Western Railway Co., or by the Transatlantic Indemnity Baggage Checking Co.'s system. Baggage of saloon passengers can be checked by any passenger train, including that appointed to run in connection with the steamer. The baggage of second cabin, intermediate and steerage passengers cannot be checked at Euston Station later than 24 hours, or at the town offices later than 27 hours before the advertised time of sailing of the steamer. The excess rate is ⅜d. per lb. (3s. 1½d. per 100 lbs.) Baggage checked more than seven days before the advertised date of sailing can only be checked by goods train. The baggage which is brought to Euston Station to be checked by a certain train should be at the station at least 20 minutes previous to the time of departure. First-class passengers are entitled to the free conveyance of 120 lbs.; 2nd class, 100 lbs.; 3rd class to 60 lbs. Excess is charged beyond these weights. All charges, including warehouse rent, when incurred, must be prepaid in London.

By the London and North-Western Railway Co.'s system of checking, the baggage is checked from London to Liverpool, delivered to the tender or to the steamer if it leaves direct from the dock. The charge for checking is 1s. per package beyond the excess charge if taken by passenger train. It includes transfer and porterage at Liverpool. On reaching Liverpool the packages are transferred by the steamship companies from the landing stage to the American steamers, on board which they are dealt with according to whether the passengers have affixed to them "state-room" (wanted) or "hull" (not wanted) labels. Baggage thus checked is not insured against sea or other risks, nor is the railway company responsible for valuable articles when sent in packages of above £10 in value. If the baggage is checked at Euston Station the charge for excess weight beyond the free allowance is ⅜d. per lb. unless the packages are checked in advance. If the luggage is checked at Euston Station not later than 24 hours before the advertised time of sailing of the steamer, the excess rate is only one-half the usual rate. If received at any of the company's town offices not later than 27 hours before such advertised time of sailing, the baggage can be checked then.

It can also be collected from the residence of the owner within a short distance of the town offices if instructions to "collect and check by passenger train" are received at those offices 27 hours at least before the advertised time of sailing. In both cases the excess rate is ⅜d. per lb. The charge for collection within the ordinary limits, or from the town offices to Euston Station is 6d. per package beyond the charge for checkage, and that for excess from London to Liverpool if incurred.

Baggage in quantities of 500 lbs. and upwards received at the town offices of the London and North-Western Railway Co. not later than 72 hours before the advertised time of the sailing of the steamer (exclusive of Sundays and holidays) can, if so ordered, be checked by goods train to Liverpool and delivered to tender. It can also be collected from the residence in London of the owner and checked, if instructions to "collect and check by goods train," addressed to Mr. D. Stevenson, at Broad Street Station, London, E.C., or at any of the leading town offices, if the baggage is received 72 hours before the advertised time of sailing of the steamer (exclusive of Sundays and holidays). In both instances the charge for conveyance from London to Liverpool, in addition to the checking charge of 1s. per package, is 50s. per ton, which is chargeable on the full weight and includes collection from the residence within the usual limits. Baggage, which is checked by goods train more than seven days' before the advertised date of sailing will be charged 1d. per package for warehousing for each day beyond seven days.

By the Transatlantic Indemnity Baggage Checking Co.'s system baggage can be checked by passenger train from London to New York, Brooklyn, Jersey City, and Hoboken, delivered to wharf, residence, hotel, or railway depôt. The charge is 5s 6d. per package if checked at Euston Station, and 6s. per package if checked at any of the town offices or collected from the residence of the owner. The excess charge, when incurred, is the same as for baggage checked under the London and North-Western Railway Co.'s system. The charge for packages checked under this method includes insurance against all kinds of risks up to the amount of £20 per package.

Baggage which is not checked to Liverpool tender or to New York but merely labelled to Liverpool Station, on the English system, must be claimed by the owners on arrival at the Liverpool Station, when it is unloaded from the car on the platform. Baggage unchecked and not travelling with the passenger but simply handed to the London and North-Western Railway Co. for transmission to Liverpool, consigned to "Mr. ——, Liverpool, passenger per (or to be delivered on board) steamer ——," is not received on board without an order from the steamship agents. It is the practice of the railway companies at Liverpool to advise the steamship agents of the arrival of such baggage, and to wait their further instructions as to where they are to be delivered. The London and North-Western Railway Co. cannot therefore undertake that the baggage will be put on board a particular steamer.

The company when required provide comfortable private omnibuses for the carriage of passengers from Lime Street Station, Liverpool, to the landing stage of the Alexandra Dock. These vehicles are capable of carrying six persons inside and two outside, and the fare from the Lime Street Station to the landing stage is 3s., and to the Alexandra Dock 5s., including a reasonable quantity of baggage. Passengers from London requiring these omnibuses should ask the Euston stationmaster before leaving London, or the guard of the train at one of the stopping stations, to order one for them, which they will do by telegraph free of charge. It is a great advantage to passengers embarking in the Alexandra Dock, that trains run at frequent intervals from Lime Street Station to Alexandra Dock Station. Passengers who go to Liverpool before the day of sailing will find at the Lime Street Station a splendid hotel, owned and managed by the London and North-Western Railway Co., and it is well appreciated by American travellers.

When desired the stationmaster at London (Euston) will call upon travellers to make arrangements for their journey to America, collect baggage, send private omnibuses in London, engage, free of charge, seats in drawing-room cars, private compartments and parlour cars for parties, secure rooms at the Liverpool Lime Street Hotel, private omnibuses at Liverpool, berths in sleeping-cars (5s. each) to Liverpool or to Holyhead in the Irish mail train for Queenstown or Londonderry, and cabins in the mail steamers from Holyhead to Kingstown.

Good through booking arrangements exist to and from the West of England. First, second, and third-class tickets are now issued between the principal stations on the London and North-Western Railway and Plymouth, *via* Bristol, and combined second and third-class tickets are issued in those cases in which passengers are booked through by trains which are limited to first and second class over a portion of the systems of this company and the Great Western Railway Co., passengers wishing to travel by the new route from the Midlands or North to Plymouth, should ask for tickets *via* Severn Tunnel. Third-class tickets are available for travelling over the London and North-Western Railway by any train except the Irish mails over the Great Western Railway by any train except that leaving Bristol for the West at 2.26 p.m., and that arriving at Bristol from the West at 12.4 noon. For the convenience of passengers travelling by these express trains in the West of England, special through tickets are issued between the principal stations available for travelling third-class over the London and North Western Railway and second-class over the Great Western Railway. The through ticket arrangements are very advantageous for ocean voyagers embarking and landing at Plymouth.

INSTITUTE OF MARINE ENGINEERS.

A MEETING of the Institute of Marine Engineers was held on Friday, the 5th of September, in the Langthorne Rooms, Stratford, when the President (Mr. Manuel, Superintendent Engineer, P. & O.S.N.Co.) delivered his inaugural address on the re-opening of the sessions. Referring to the decease of the late Mr. James Nasmyth, Mr. Manuel paid a high tribute to his worth and to the work he accomplished in his day and generation, leaving also behind him as a legacy to the nation the wealth of his inventions, and a life-history, as related by Smiles, and well worth the perusal and study of all men, old, and young especially. Turning to the most recent types of ocean steamers built for the Atlantic trade, comparison was made between the *City of Paris* and the *Teutonic* and *Majestic*, the difference in the disposition of the propellers being illustrated by models showing in the case of the *City of Paris* the propellers placed on either side of the hull, the shafts for a considerable distance overhanging beyond the actual framework and supported by outside bearing brackets. In the *Teutonic*, the propeller shafts are several feet nearer to one another laterally, the hull of the ship being built so as to embrace the shafts right aft, and the aperture made for the screw to revolve in, as is usual in single screws, while the propellers are placed one in advance of the other in order to admit of a sufficient diameter, and yet allow the shafts being kept as close together as possible. The advantages and disadvantages of the two styles were remarked upon, and special reference was made to the disaster which occurred to the *City of Paris*, and the various ideas which had been advanced to account for the enormous damage done to the machinery.

The results shown by the respective steamers indicate a superiority of the Belfast-built steamers *Teutonic* and *Majestic*, as they can accomplish the race across with slightly better speed on a less consumption of coal and carry more cargo; the latter items being of most importance to the owners. Ireland may thus be said to carry the palm as the victor in the great ocean race. The boilers in the steamers quoted are worked under forced draught, but of different systems, Inman Line steamers being fitted with closed stokeholds and cold air blast, while the White Star steamers are fitted with hot air blast on Howden's principle. All are, however, worked at comparatively low air pressures, giving from 14 to 16 I.H.P. per square foot of grate surface.

Mr. Manuel then proceeded to comment upon the use of steel for crank and other shafts, and pointed out that the superiority of steel over iron—excepting propeller shafts—is so great that it seemed strange that allowance should not be made by the Board of Trade and Lloyd's, and a reduced diameter be allowed in the case of a steel shaft being fitted in preference to an iron one. In reference to propeller shafts these also might be made of steel if fully protected by brass liners at those portions exposed to the corrosive influence of sea-water. Cases were cited where the whole length of propeller shafts had been successfully covered, the brass liners having been shrunk on 10 ft. or even 18 ft. long.

A passing reference to marine boilers was made and the fact that it is an exceedingly rare occurrence for a boiler to burst on board ship, while on land it has been otherwise, many lives being lost annually by explosions to land boilers. The inference is that the greater care and attention bestowed upon the former speaks for itself in the comparison. In concluding, Mr. Manuel commented upon the present or recent unhappy relations which seemed to exist between employers and employes of labour, and suggested that the labour question was one which might well form the subject of a paper to be read and discussed by the members of the institute. A closing reference was made to technical education and the means which now exist for young men to advance their knowledge and information upon all subjects, and it was urged that the means should be taken advantage of to the utmost limit, and while advocating hard study for self-improvement and the advice which Mr. McFarlane Gray had so frequently given to young men in regard to this, Mr. Mannel also urged that some time should be devoted to recreation, and he hoped that the institute and the committee appointed in connection with this should arrange for an evening or two when members might meet. Some remarks were made to the effect that the social element should not be forgotten in the ensuing winter's arrangements.

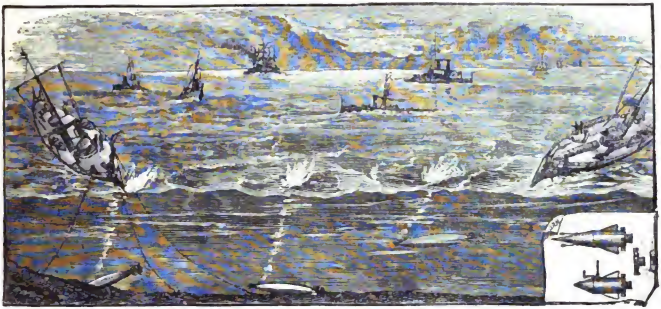
The honorary treasurer, Mr. Leslie, submitted a cash statement, showing a balance in hand of £214 at the end of August, a large number of subscriptions being due and that these when paid would more than pay outstanding accounts and leave a much more substantial balance.

The honorary secretary made a few remarks expressing the pleasure he felt in seeing a good representation of Cardiff members and proposing that the paper on "Water Jet Propulsion," by Mr. J. R. Ruthven, should be read simultaneously in London and Cardiff on the 16th inst., referring specially to Mr. Elms, who had been very energetic in working in Cardiff in connection with the institute, and who might be induced to undertake the arrangements. The proposal was seconded by Mr. Churchill and agreed to. Mr. Elms (Cardiff) spoke on the interest he felt in the institute and the power and influence he thought it was exerting. He agreed to endeavour to carry out the proposal made by the honorary secretary.

The meeting closed with a vote of thanks to the president, moved by Mr. Bisset and seconded by Mr. Coubro.

THE HOLMES TORPEDO-FINDER.

THE Naval Manœuvres of 1890, the success of which, although regarded by some as having been somewhat disappointing, cannot, we think, be so regarded by those whose special training and knowledge of things naval leads them to look beyond the mere fact whether the division commanded by Sir George Tryon did or did not find that under the command of Sir Michael Seymour within the stipulated ten days.



The experiences gained during these Manœuvres have been great, both to the Admiralty authorities and to those who actually took part in them, and will stand them in good stead should mimic warfare ever be converted into that of stern reality.

Among the other lessons learned is the utility, and disastrous results worked on ships at sea, as well as in harbour by the Whitehead torpedo. This engine of destruction, as our readers know, is a cigar-shaped Whitworth steel cylinder from 14 to 19 ft. long, and from 14 to 16 in. in diameter, divided into three compartments—head, centre, and tail. The head contains the explosive—generally about 70 lbs. of wet gun cotton—in touch with a primer and detonator, which on coming in contact with the hull of a vessel or any other resisting substance, immediately explodes. The centre chamber holds the machinery and mechanism for adjusting the machine to remain at any desired depth it may be required to travel under water; the tail contains the double screw propeller.

The motive power is supplied by a small engine capable of indicating 40 H.P., but so compact that it can be made to weigh only 35 lbs. The shaft revolves with immense rapidity, and at its end, in the tail of this mechanical fish, as we have said, is the double screw propeller, two sets of spiral flanges revolving in opposite directions, the one set being fixed on an outer tube-shaft over the inner solid shaft, which bears the other set. The propeller flanges have a diameter of 13 in., and the working pressure of air in the tail chamber is usually about 1,000 lbs. per square inch, giving to the torpedo a maximum speed of 27 knots an hour. In front of the propellers are four well-proportioned tail-fins, one pair being the vertical rudders permanently adjusted to keep the torpedo in a straight course directed to the object of its attack, the other pair are the horizontal, and are acted upon automatically by a contrivance which maintains the torpedo at the desired depth.

This torpedo is aimed and discharged from a tube, either on deck or below water, according to the fittings on board the torpedo-boat, and when free of the tube the engines commence to work, and certain is the destruction to all before it.

Hitherto the great drawback to the success attending practice with the Whitehead torpedo was the great difficulty in tracing its direction under water after leaving the discharge tube, consequently practice with this costly weapon was entirely confined to very shallow water, and even then the time wasted in trying to find the mechanical truant had the effect of seriously disrating its value. To obviate this drawback the "Holmes Torpedo Finder" has been invented by Mr. Joseph R. Holmes (managing director of the Holmes Lights Co., Limited), which, from its simplicity and ingenuity of construction, has proved of great value to our own Navy, and we understand that foreign governments have not been slow to take advantage of it.

The "Finder," which our illustration shows in operation, consists of a small barb-pointed receptacle which is attached to the head of the torpedo previous to

Google

its being discharged, and when required for use an opening is made to allow the ingress of salt water, which, on contact with a specially-prepared chemical contained within, produces a powerful gas, which, on reaching the surface of the water, bursts into a brilliant flame, and by this means indicates the travel or position of the torpedo under water, and renders its recovery a matter of certainty and ease.

In actual warfare this apparatus would, of course, not be used, but for training our Naval officers and men in the uses and ways of the Whitehead torpedo, its value has been amply established by the recent Naval Manœuvres.

A VISIT TO THE BREMEN EXHIBITION.

(Continued from page 234.)

THE "Maschinen-Halle," or machinery division, although large, is not of so much interest to the marine engineer as might have been expected, being chiefly occupied by gas and petroleum motors and other small articles. Entering the western door we took a hurried run through the building, noting the most important exhibits. The first three or four stands, which are occupied with sewing machines and gas cooking apparatus, we pass by, and noting on the right a good display of petroleum engines, from ½ H.P. upwards, all working, and a small 6 H.P. steam-engine for driving light machinery. On the left hand are some large printing presses, on one of which the evening edition of the *Weser Zeitung* is printed. Now we come to a long row of uninteresting machines for chopping meat, burning coffee, knitting, and the like. In an adjoining hall, however, are some fine arrangements for electric lighting and signalling shown by Mr. Emmanuel Berg, Berlin. Among them a complete night signalling apparatus for a man-of-war. This firm also exhibit a set of electric telegraphs from bridge to engine-room of steamers, the principal novel feature of which is a return signal repeating the order on the bridge as delivered in the engine-room, and signalling again from the engine when the order is executed. Messrs. Bestenbostel & Sohn, Bremen, have exhibited a compound condensing engine of 120 E.H.P. Messrs. Garrett, Smith & Co. show three portable engines of various sizes and two Westinghouse engines with self-regulating expansion and compression worked direct from the governor. In this division are also various examples of packing for steam pipes, &c. Returning again to the large hall to continue our round, we noted some good exhibits of smaller machine tools, slotting, planing, boring, screw-cutting, and shaping machines by the Deutche Werkzengmaschinen Fabrik, in Chemnitz. Beyond the above noted are few exhibits of interest, the other stands being chiefly occupied by circular saws, gas stoves, chain tackles, and such like articles, which, although all very good and well-finished, are nothing new.

At the western end of the building two hydraulic cranes are exhibited. The one from Messrs. Hanlel & Lueg, Düsseldorf, arranged for harbour and railway purposes, the lower platform resting on four pillars to allow a railway waggon to pass through below. The other, exhibited by the Gutehoffnungshütte Actien Gesellshaft, is a Neukirch patent swing crane as fitted in the Bremen Free Harbour and can be brought to bear on almost any point within a circle of about 40 metres diameter.

THE BOILER-HOUSE.

Here are some good exhibits. Messrs. Dürr & Co., Ratingen, have a tubular boiler, on which Mr. W. Dürr's Dasymeter is in use, an invention for testing the economical working and stoking of a boiler. It is composed of the Dasymeter proper for showing the amount of acids, &c., in the smoke gases, a zugmesser for measuring the strength of the draught, and a pyrometer for showing the temperature of the various gases. Messrs. Bestenbostel & Sohn have a boiler with the Donneley patent furnace, working at a pressure of 10 atm. with a heating surface of 100 qm., and producing about 3,600 lbs. of steam per hour. Messrs. Behne & Herz exhibit a boiler with the Behne patent smoke-consuming furnace. From the Blechwalzwerk Schulz Knandt a boiler is exhibited with the Fox patent flue, with about 60 qm. heating surface, the diameter of flue being 1,250 and 1,350 M.M. The Bremen Schiffbaugesellschaft are also represented, having exhibited a boiler with 90 qm. heating surface.

Passing round the back of the Maschinen Halle are various smaller pavilions, in which are the mining exhibits, such as specimens of coal and other minerals; also the tools used for mining purposes. The various rolling mills are also well represented with numerous samples of steel rails, angles, and bars, before and after being tested.

Before closing our notes the exhibits of the Weser correction in the Architecten Haus must be mentioned. They comprise two large models, one of the river from Bremen to the sea, showing where the bed has been or shall be altered, and the other, on a larger scale, shows the manner in which the work is executed. The water-level is represented by a sheet of glass, on which are floating dredgers, hopper-barges, and other craft as employed in reality. At one end is a large dam of bushwork built and being sunk into position, while in another part a dredger is at work. The models are very complete, and give the visitor a clear impression of the great work being carried out in the soft, loose, sandy bottom of the Weser. On this undertaking are day and night, by the aid of electric lighting, employed at present: five dredgers, class A, capable of discharging into the hopper-barges 120 cubic metres per hour; one class B, 200 cubic metres; and two, class C, 250 cubic metres, besides a large pumping dredger. In addition, 22 steam hopper-barges, and 60 smaller ordinary hopper-barges, 5 tugs, besides 10 smaller steamers and launches, for the inspecting engineers. Another similar and interesting model is that of the new harbour in Bremen, which has a length of about 2,000 metres and a breadth of about 120 metres, and is fitted with all the newest appliances for the quick discharging of cargo. This splendid harbour will, doubtless, when the Weser has been deepened, as proposed, enable ships with a draft of 5,000 M. to accept freight direct to Bremen, and draw a large amount of business to Bremen and the surrounding country. In the year 1886, before the Weser correction commenced work, Bremen was not accessible to vessels drawing more than 2,750 metres, and now, after about two years' work, vessels can proceed to Bremen at high water with a draught of 4,000 metres.

ELECTRICAL EXHIBITS AT THE EDINBURGH EXHIBITION.

AMONGST the electrical exhibits we find those of Messrs. Ernest Scott & Co., Close Works, Newcastle-on-Tyne. The plant comprises a 9½ in. by 9 in. vertical high-speed engine, driving a 15-unit "Tyne" compound wound dynamo; an 8¼ in. by 8 in. vertical engine of the same type, driving an alternating current dynamo; a 6½ in. by 6 in. vertical engine, similar to the above, coupled direct to an 80-light "Tyne" slow speed dynamo, this last being suitable for ship lighting. The engines are all of a special design, suitable for electric light driving and arranged so that little or no attention is required for lubrication, the crank shaft running in oil. This class of engine can be placed in the hands of inexperienced drivers without fear of trouble, the regulating governor for controlling the speed being of the well-known Pickering style, which, working on to an equilibrium throttle-valve, maintains a constant speed under varying loads.

We illustrate the 15-unit "Tyne" compound wound dynamo in Fig. 1. This is of the makers' standard pattern, and it will be observed that the machine is not only very substantial in construction but arranged so that it can be taken to pieces, if desired, by simply removing four bolts, permitting the top half of the machine to be lifted off and the armature taken out. The armature is of the firm's particular design and so wound that not only has it perfect ventilation, but in case of an accidental burning out of any of the coils, a new coil can be wound on without removing the armature spindle from the machine. The dynamo, although of the 4-pole type, is so cross connected that two brushes only are used, which very much simplifies and reduces the time and attention which a dynamo requires when running. The commutator is of hard drawn, high conductivity copper, the sections being insulated from each other by mica. The copper segments are mounted upon a gun-metal sleeve, secured by coned ends and a lock-nut to the copper sections. This method of construction admits of the commutator being taken off and replaced without the segments falling to pieces, and in places where the dynamos are likely to be placed in the hands of inexperienced men this is a matter of considerable importance. In most cases the commutator strips are simply mounted upon the spindle and held in position by a nut. About 200 16-C.P. incandescent lamps are being supplied by this machine in the Machinery Court and Locomotive Section.

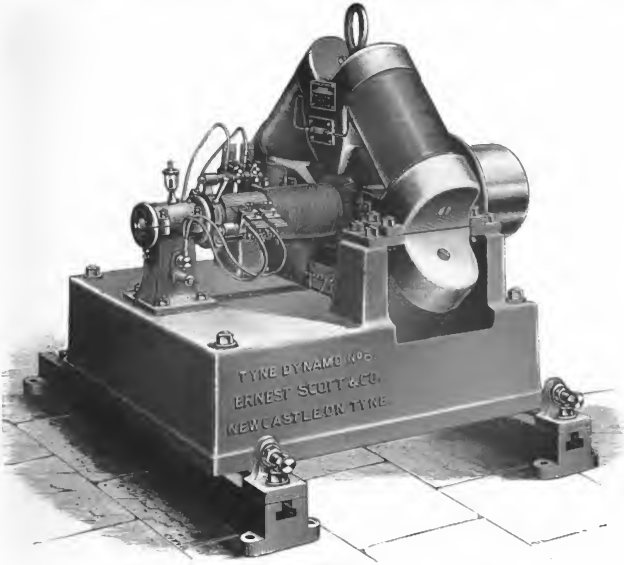

TYNE DYNAMO Co.
ERNEST SCOTT & Co.
NEWCASTLE ON TYNE

Fig. 1.

The "Tyne" alternating current dynamo, which is illustrated in Fig. 2, is shown in practical work. This dynamo is designed to give an output of 1,000 volts and a current of from 10 to 15 ampères when running at a speed of 1,200 revolutions per minute. On reference to our wood-cut, it will be observed that the machine in question is fitted with 10 magnets, arranged radially round the magnet frame and looking inwards. These magnets are wound with insulated copper wire and are excited by an ordinary dynamo, which, however, can be coupled direct to the dynamo spindle if desired. Within the poles of the 10 magnets the armature revolves and is wound with 10 sections of insulated wire. The armature core is built up of rectangular iron wire, each also being insulated by thin paper, the wire being primarily wound upon a gun-metal hub. This system of construction admits of the most perfect ventilation being attained. It also enables the sections to be examined, and as each section, both in the magnets and armature, has been carefully calculated to give the most perfect electrical results, combined with mechanical efficiency, the machines work without heating and can run continuously under full load. When working below the normal load they are also extremely efficient. The current from the armature is led by copper conductors, carefully insulated with india-rubber, to the collector, which consists of two gun-metal rings mounted upon a hollow gun-metal sleeve. The collecting rings are insulated from the sleeve by means of ebonite rings and washers. The current from the collector rings is taken up by two brushes, supported in brush-holders, the spindles of the latter being insulated from the frame of the machine by ebonite brushes and washers, ensuring perfect insulation.

Messrs. Ernest Scott & Co. make the bearings of their dynamos of cast-iron pedestals accurately bored and fitted with adjustable caps, the bearing itself being fitted with gun metal brass in halves and lined with "Esco" anti-friction white metal. This method permits of easy adjustment, and in case of wear the brass can be removed from the machine and run up with new metal without having to remove the pedestals themselves.

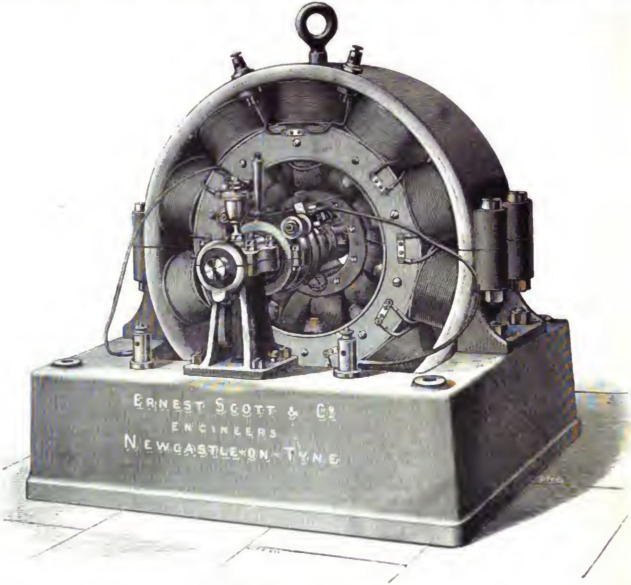


FIG. 2.—ALTERNATING MACHINE.

The summary of the current supplied by Messrs. Ernest Scott & Co. at Edinburgh includes the lighting of the saloon carriage and engine-lamps on the exhibits of the North Eastern and North Western Railway Co.'s stands, also that for working the model of the *Dreadnought*, and the North Western Co.'s tube-cutting machine. In addition the firm supplies the following in the grounds:—About 150 16-C.P. incandescent lamps, viz., at Mr. McKenzie Ross' Refreshment Rooms; the Fish Dining Rooms; the Queen's Tea Room; Messrs. Cadbury's Cocoa and Smoke Rooms; and the Venetian Glass Works. In each of these last places the firm's "Tyne" Transformer (Fig. 3) converts the current which enters at 1,000 volts to an E.M.F. of 100 volts, rendering it perfectly safe. As an instance of the economy effected we may mention that the high tension current requires copper cables consisting of seven wires of No. 20 B.W.G., whereas to use an ordinary low tension the cable necessary would be 19 wires of No. 15 B.W.G. The cost of the former is £38 per mile, whereas that of the latter is £377. The state of efficiency that has been arrived at may be gathered from the fact that 97 per cent. of the current entering the transformer is afterwards made effective. The high power is a concentrated one, whereas the lower is more diffused. It is not difficult to understand, therefore, that there would be a loss of energy by a system of the latter kind as against the former. These transformers admit of the ready removal of the primary and secondary coils, upon which the high and low tension currents are delivered and taken off respectively. Simply by removing the cap both sets can be taken off and replaced easily. For outdoor work and to conform to Board of Trade rules the transformers are placed in cast-iron boxes with watertight doors, the two fuses being mounted on porcelain vases placed inside the box. The transformer itself being insulated from the box it is impossible for anyone to get a shock by touching it, should there be any leakage on the mains.

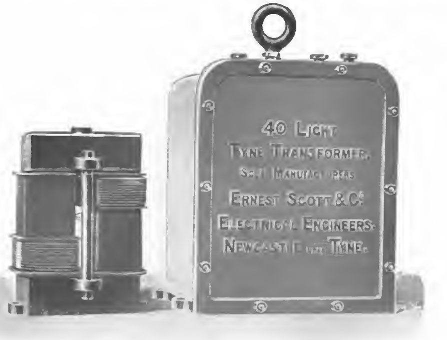


FIG. 3.

Messrs. E. Scott and Co., are well-known makers of fans with engines usually attached direct. When made with cases, which are of cast-iron and open at the side, the shaft is supported in bearings, the blocks for which are upon legs of the same radius as the fan itself. The engine is then horizontal, and stows neatly away. In another (covered in) pattern (Fig. 4) the engine is vertical. The merit of this form is that of compactness and consequent lighter weight for the same work. In closed stokeholes the firm appear to recommend their combined fan and engine; the former without a case. This system admits of the apparatus being bolted to the stokehole bulkhead direct, and so quite out of the way. All moving parts are of steel, including the crank shaft, and all bearings of gun metal, lined with the firm's special white anti-friction metal. Sufficient has been said to show that Messrs. Scott spare no pains to put themselves in the front rank in all they take in hand, by producing the best class of work. The list of customers they furnish is alone a proof of this.

MESSRS. WM. SIMONS & CO., of Renfrew have received an order to construct a steel screw passenger steamer for American service.

THE Clyde Steam Navigation Co. have decided to make Dover a port of call, and, in order to give them every facility, the Harbour Board are erecting wharves on the quays.

ROYAL NAVAL EXHIBITION.

A MEETING of the sub-committees of the Naval Exhibition was held at the Admiralty, last month, and there were present the Duke of Edinburgh, K.G., Admirals Sir William Dowell, Sir E. Englefield, Mayne, and Colomb, Sir George Chubb, Captain Pusey, Mr. A. B. Forwood, M.P., Mr. G. B. Voules, Mr. R. D. Awdrey, and Captain Jephson (hon. secretary). Sir William Dowell presided.

The committee decided, after discussion, to hold the exhibition on the grounds of the Chelsea Hospital if they can arrange to obtain from the Chelsea Commissioners an additional three acres of land adjoining the present site. This extra space they desire to obtain in order to enable them to have evolutions of bluejackets and naval drill and exercises, as these require considerable space, and will be a special feature in connexion with the outdoor entertainments at the forthcoming exhibition.

The exhibits will be confined to matters solely connected with the Naval Service.

The committee are making an appeal to all who may possess any works of art, relics, mementoes, or trophies connected with naval history or illustrative of naval warfare which may be in the possession of private persons or in public collections, and they specially desire all who may possess such articles to communicate with the honorary secretary, Captain Jephson, R.N., at the offices of the exhibition, 6, Craig's Court, S.W. The names of the gentlemen in the several sub-committees, who will have the custody of any loan collections, sufficiently guarantee that the utmost care will be taken of the treasures committed to their charge.

At a meeting of the general committee of the Royal Naval Exhibition held at 6, Craig's Court, Admiral Sir William Dowell was elected chairman, and Admiral Sir William Houston Stewart vice-chairman of the general committee. Mr. Edmund H. Lloyd, manager to the Royal Military Exhibition, was appointed manager. Messrs. Harlett & Co., St. Martin's Lane, were appointed bankers. The guarantee fund was announced as £33,705. After several additions had been made to the various sub-committees and other business transacted the meeting was adjourned.

THE Great Eastern Railway Co. is about to add three steamers to its Continental fleet. The Manchester, Sheffield, and Lincolnshire Railway Co. has also ordered four additional steamers for its Continental trade.

LAUNCH OF THE "INFANTA MARIA TERESA."

ON August 30th a belted cruiser of the first-class, bearing the name of the *Infanta Maria Teresa*, was successfully launched from the new shipbuilding yard of Martinez Rivas & Palmers, on the Nervion, near Bilbao. The vessel is constructed from designs made by the Palmer Shipbuilding Co., under the superintendence of the English engineers, Messrs. Wilson & Clark. She is of the *Undaunted* and *Orlando* class, and is the largest and most heavily armed vessel built in Spain. The cruiser is between perpendiculars 340 ft. long, and over all 364 ft. Her extreme breadth is 65 ft., and her displacement, when fully laden, 7,000 tons. She will be fitted with twin-screw triple-expansion engines of the inverted vertical cylinder type. The collective power guaranteed under forced draught is 13,000 I.H.P., and with natural draught 9,000 I.H.P., giving a speed of 20 and 18 knots respectively, and she is to be armed with two 28-centimètre guns, ten 8-centimètre, eight quick-firing 6-pounder Nordenfelts, eight revolving 3-pounders, and eight torpedo tubes.

The launch yesterday was an event of lively interest. Not only Bilbao, but all Spain took part in the national festival It may be said, indeed, to have been international, as the English element was very largely represented.

Queen Christina arrived by train from San Sebastian at two o'clock, and proceeded at once to the yard. She was accompanied by the Prime Minister, Senor Isasa, and a large suite. Her Majesty was received at Bilbao by the local authorities, and large and enthusiastic crowds showed marked expressions of respect and loyalty along the route to the yard. At the little station at the works, which was appropriately decorated and adorned with the Spanish and English colours, the Queen was received by Senor Martinez Rivas. Sir Charles Palmer, Lady Palmer and several ladies of the locality were presented to her Majesty, who at once proceeded to a small covered tribune, constructed close to the bows of the vessel. The manager of the yard, Mr. Wilson, handed to the Queen a pair of gold jewelled scissors, beautifully designed in the form of an anchor, bearing an appropriate inscription. The magnificent vessel glided gently into the water amidst a medley of Spanish vivas and British hurrahs from the immense concourse of people lining both sides of the river. The procession was re-formed, and the Queen was conducted to an immense building, which is now being erected as a gun foundry—for Messrs. Rivas & Palmer are determined not to do things by halves, but intend to construct not only all machines for war ships, but heavy armaments as well—where lunch was prepared for 500 invited guests.

Sir Charles Palmer has every reason to congratulate himself on the successful issue of his plucky venture, and Senor Martinez as a Spaniard on his alliance with his English associate. It has been a matter of surprise and satisfaction to English and Spaniards alike that this magnificent vessel has been put into the water 13 months from the laying of the keel, and there is much significance in such a vessel being floated after construction, in a country where there is practically no experience of shipbuilding, in so short a time, the manual labour and material used being almost exclusively Spanish. Two sister ships are in a forward state on the slips alongside that vacated.

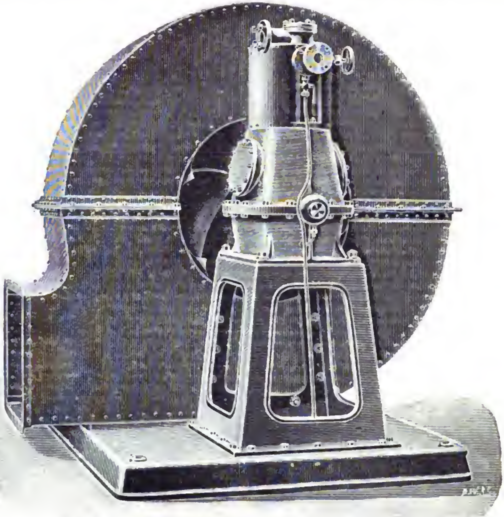


Fig. 1.—*(For description see page 293.)*

LAUNCH OF H.M.S. "PHILOMEL."

ON August 28th the *Philomel*, a second-class twin screw cruiser, of 2,575 tons displacement and 7,500 I.H.P. was successfully launched from Her Majesty's dockyard at Devenport. She is one of a class of cruisers known as the *Pandora* type, the building of which was provided for in the last naval defence scheme. The *Philomel* is constructed of steel throughout, and is of the following dimensions:—Length, 265 ft.; breadth, 41 ft.; draught of water, forward, 14 ft. 6 in.; aft, 16 ft. 6 in.; mean, 15 ft. 6 in. The displacement of 2,575 tons is made up as follows:—Weight of hull, 1,030 tons; weight of engines, 540 tons; coal capacity, 300 tons; and weight of stores and equipment, 705 tons. The machinery has been constructed by the Earle's Shipbuilding Company, Hull, at a cost of £42,000, and consists of two sets of triple-expansion engines, having cylinders of 30·5 in., 45 in., and 68 in. diameter, with a stroke of 33 in. The estimated horse-power is 4,500 with natural draught, and 7,500 under forced draught. Steam is generated in four double-ended steel boilers, each 17 ft. 3 in. in length, by 12 ft 6 in. diameter, with a working pressure of 155 lbs. to the square inch. The propellers are three-bladed, of 12 ft. 6 in. diameter, with a pitch of 14 ft., and will be driven under forced draught at about 160 revolutions, giving a speed of 19 knots, while with natural draught the revolutions will be about 140, and the speed 16 knots. A steel protective deck runs right fore and aft, the thickness in wake of machinery spaces ranging from 1½ in. to 2 in., and varying at the extremities from ¾ in. to 1 in. The *Philomel's* armament will consist of eight quick-firing 4·7in. guns, eight 3-pounder quick-firing guns, one 6-pounder quick-firing gun, and four five-barrel Nordenfeldts, besides which she is provided with two torpedo tubes and two carriages for launching torpedoes. She will be lightly rigged with fore-and-aft sails. the area of plain sail being 5,030 square feet. The total cost of the *Philomel*, when ready for the pennant, is estimated at £146,114, and she will be commissioned with a complement of 215 officers and men.

EXHIBITION OF MINING AND METALLURGY AT THE CRYSTAL PALACE.

THIS exhibition has now been open for some time, and to those who take an interest in things pertaining to mineral and metal working, will amply repay a visit. Of course we did not expect to find much, on our recent visit, that would *per se* interest marine engineers. Yet there are a number of exhibits that may be examined even by them with interest.

Among them, Mr. John Spencer, of the Globe Tube Works, Wednesbury, shows a collection of tubes and fittings of all kinds, including tubes and cylinders for compressed air, cove bars, cocks, valves, &c., and coils for heating, super-heating and refrigeration, which we understand Mr. Spencer makes to 500 ft. without joint. Messrs. John Davis & Son, of Derby, London and Cardiff, show the English electric telephone, theodolites, extra telescope for vertical sighting, electric tremulous bells, indicators, as well as miners' dials, and a collection of extras and accessories, &c. The Mechanical Appliances Co., of 63 and 64, New Bond Street, London, have a collection of engineers' tools, machinery and hardware, machine screws, bolts, nuts, &c., steel wire casting brushes, bright turned iron and steel shafting, couplings, &c. These steel wire brushes are specially adapted for cleaning ships' sides and anchors. Messrs. A. Haacke & Co., of Liverpool and London, show samples of their well known fossil-meal compositions for boilers, steam-pipes, cylinders, &c., to prevent loss of heat. Messrs. Woodhouse & Rawson, United, Limited, show a collection of their electrical appliances of every description. Mr. L. Bristol, Park End, Bromley, Kent, shows a portable electric safety lamp. In a luminous cottage, Balmain's luminous paint is shown in various applications, as well as luminous life-buoys. We have by no means exhausted the list of stalls worth inspecting, but have said as much as may perhaps induce those of our readers who have not already done so, to pay the exhibits in the Crystal Palace a visit.

Shipping Contracts.—Messrs Caird & Co., shipbuilders, Greenock, have contracted to build and engine, for the Greenock Steamship Co., two steamers of 5,000 tons, for the Gulf Line. These will be the largest steamers the company have.

A NEW CEMENT FOR STEAMERS.

THE Light Asphaltic Cement Syndicate, Limited, who have their chief offices at 158, Leadenhall Street, London, have had very good results from the application of their patent "Light Asphaltic" Marine Cement, which is a substitute for Portland and other cements, and the chief features of which are lightness, adhesiveness, great elasticity and indestructibility.

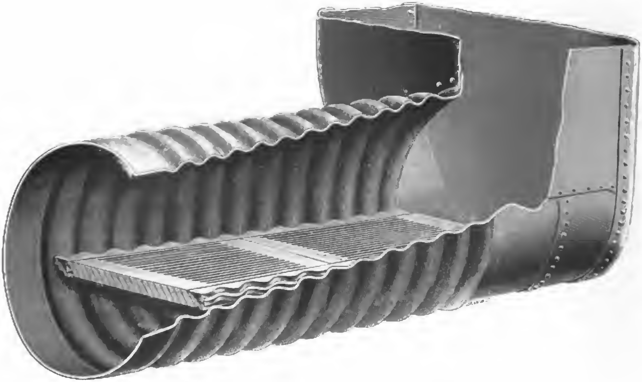
This cement consists chiefly of ground corkwood and asphaltum, and is an eminently suitable substitute for Portland or other marine cements presently in use. Its specific gravity is from 50 to 75 per cent. less than any other marine cement. It can therefore be applied level with the lower limber holes of steamers' ballast tanks, largely reducing the weight, and thereby increasing the carrying capacity to the extent of one to two per cent., while the water from the ballast tanks can be completely drained out. As it cannot crack or blister and is absolutely adhesive, holding perfectly to the closest grained steel or iron, it forms a thorough protector against rust. It does not melt, except in very high temperatures, and even then it cannot run, the presence of the ground corkwood keeping it in the same position in which it was applied. Another great advantage it possesses is, that it is absolutely impervious to the action of salt water and many acids, and is in fact indestructible under the influences to which it is exposed in a ship's double bottom, bilges, and tanks.

It may therefore be claimed for this cement that it combines every possible advantage which can be produced in a marine cement, that is, *lightness*, *adhesiveness*, *indestructibility*, and *permanent lasting capacity*. With these advantages, it will surprise us if it does not meet with a ready and hearty reception at the hands of the mercantile marine and navies of the world.

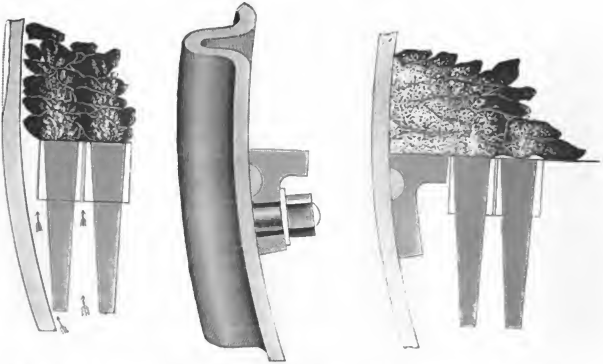
As a practical example of its great advantages, assuming that a vessel of 4,000 tons would use 75 tons of Portland cement, gravel and sand, it is estimated that a vessel of this size could be properly coated up to the lower limber holes with 12 tons of the light asphaltic cement, thus giving an increase of carrying capacity of 63 tons. Of course similar proportions may be calculated for vessels of smaller or larger sizes, and for light-draught river steamers, torpedo boats, or craft of high speed it should prove invaluable, as every ton of weight saved in such vessels is of the utmost importance.

We understand that Messrs. the Holzapfels Compositions Co, Limited, of 57, Fenchurch Street, London, E.C., and Newcastle, Liverpool, Glasgow, and Cardiff, have been appointed agents for the syndicate in the North of England and in Scotland and Cardiff, and have already applied this cement to several vessels with much success. They will supply samples to anyone requiring same, and are prepared to give lump-sum offers for cementing and coating vessels of any size at any port in their district.

Angier Brothers' Steam Freight Report, September 20th, 1890.—Freights since our last report have been uniformly dull, with a very restricted business and but little fluctuation; profits are very difficult to make in any direction, even with cheap new steamers. China and East India rates keep very low, and hardly any demand for tonnage. Azoff, Danube, and Black Sea rates are all down 3d. to 6d. per quarter, and the business doing very limited. Mediterranean and Baltic employment leaves poor results. In the American and Canadian trades grain freights are almost unprocurable. Cotton rates are easier at a decline, but promise improvement. Oil cargoes are scarce. Cattle and deal rates are weaker. West India employment is scarce. From the River Plate very little is doing. Outward coal rates are a shade better to India, but otherwise unaltered and hardly worth taking. Berth rates are down for Australia, Colonies, India, and China, but rather better for River Plate. Bunkers continue very high priced, and not readily obtainable; wages keep up, and insurance is dearer. Labour Unions continue their aggressive tyranny, submission to which would render it impossible for an owner to control or work his own property. The Shipping Federation is now in working order, and will enable every owner to resist all interference, and retain his freedom to employ what labour he chooses, and at such pay and conditions as the supply of labour and freights admit. New steamers are rather dearer, but second-hand boats are not so saleable except at a decline.



Marine Boiler Furnace, showing application of Patent Side Bar.



Section showing a present ordinary type of Fire Bar. | Section showing attachment of Patent Side Bar. | Section showing Patent Side Bar in use with ordinary Fire Bars.

FOX'S PATENT ASBESTOS PACKED SIDE BARS.—*(See page 297)*

FOX'S PATENT ASBESTOS PACKED FIREBARS.

NO sooner is one improvement made in the complexity that the engineering of the present day has reached, than some evil more or less stringent appears of which we were not previously aware. Forced draught is at present the offender, and we are told by the makers of the firebars under notice that the action of the great heat on the line of the bars and the variations of temperature produces corrosion and pitting inside the boiler. The reason assigned for this state of things is that the water in this position is decomposed, the hydrogen set free, and oxide of iron formed. By some people corrosion here has been attributed to ordinary causes. The makers affirm, however, that all the trouble is due to excessive heat continually playing on the plates, the fire in fact having a blast furnace action on the metal, and so rendering a wasting away a certainty. It is sought to remedy the evil by these patent firebars. With ordinary bars it is evident the air has as much freedom along the side of the furnace as anywhere else. Hence the damage to the interior, which is said to extend just at the level of the fuel to a depth say of three inches below the surface on both sides depending upon the thickness of the fire. By the illustrations it will be seen the bar is made to fit the furnace corrugations and has a groove formed along its length for the reception of asbestos rope or packing which, on the bar being secured to the furnace by studs or otherwise, makes an absolutely tight joint between the bar and the furnace, thus cutting off the air supply to the fuel in immediate contact with the side. It is sought thereby to do away with the unequal and high temperature common with ordinary firebars. The bars are said to have been thoroughly tested under different conditions of natural and forced draught, and to have given every satisfaction. They are, moreover, being largely fitted in steamers. Reference may be made, we are informed, to Messrs. Thomas Richardson Sons, of Hartlepool, who have fitted some boilers with this patented method and where no signs of any waste along the firebar line are at all observable.

The invention has the merit of being a simple one and therefore easy of application, while it in no way interferes with the use of ordinary arrangements in furnaces. Any plan by which the life of expensive boilers may be prolonged is worthy of attention, and the success that has been attained of recent years in this particular is only likely to lead to further efforts in the way of perfection. We must refer for further information to the makers, the Leeds Forge Co., the introducers of the well known furnaces which have received such universal acceptance. Each side bar is supplied ready for fixing and with the requisite quantity of packing and studs.

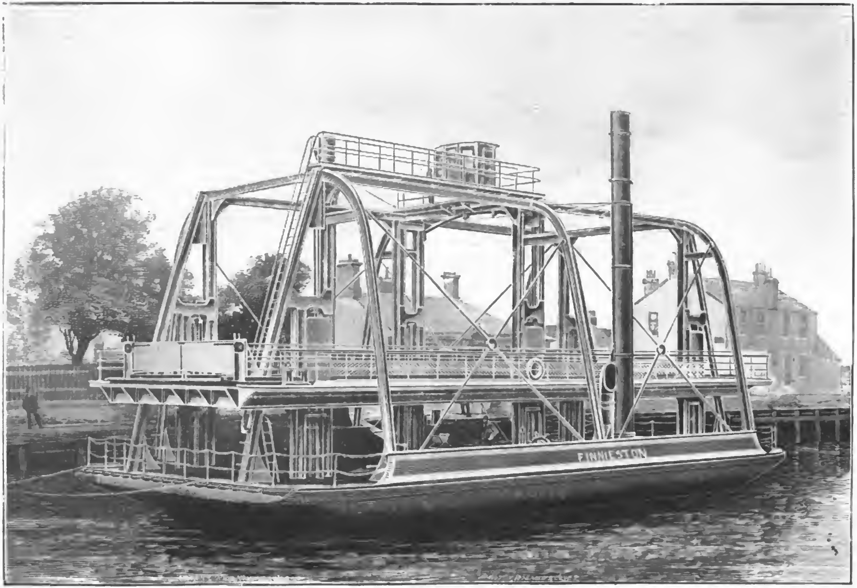
STEEL LIGHTERS.—On Tuesday, September 16th, Messrs. Edward Finch & Co., Limited, launched from their shipyard, Chepstow, three more 150-ton steel lighters for the Admiralty.

THE SOUTHAMPTON NAVAL WORKS.—The managers of the Southampton Naval Works (Limited) have secured an order from Messrs. Dessen Bros., of London, to build a steel sailing ship of about 2,200 tons net register; an order from Mr. D. Fuhrmann, of Hamburg, for a small steamer; and also an order from Messrs. Jacob Walter & Co., of London, for a small steamer. These make eight contracts fixed in the last three months by this company.

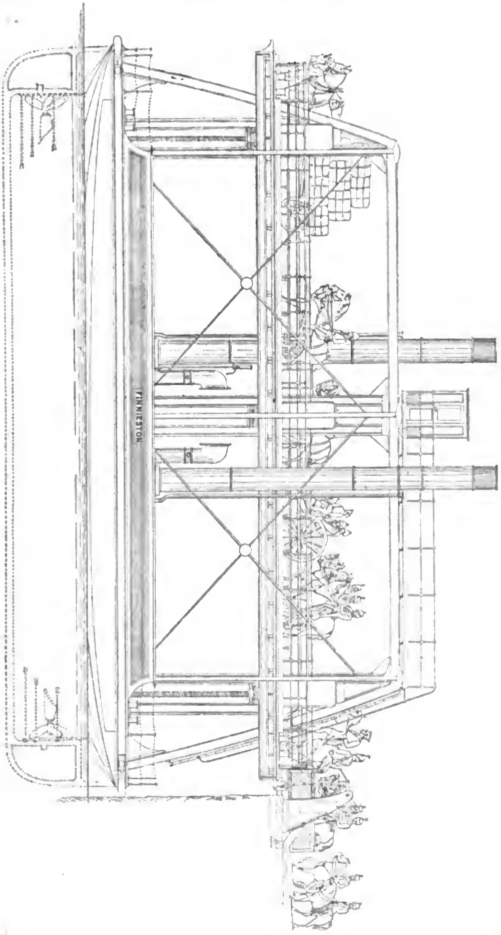
THE NEW ELEVATING FERRY STEAMER "FINNIESTON" FOR GLASGOW HARBOUR.

WITH this number we have pleasure in presenting illustrations of the unique ferry steamer *Finnieston*, recently built by Messrs. Wm. Simons & Co., of Renfrew, and now doing excellent service across the harbour of Glasgow at Finnieston. The necessity for some mode of cross-river communication at Finnieston, accommodating carriage as well as passenger traffic, has long been apparent, but it was only after much discussion and varied proposals concerned with swingbridges, high-level bridges, subways, &c., that the Clyde trustees fixed upon this new style of ferry steamer as best suited, in their judgment, to meet the wants of the public. The hull, which is constructed chiefly of steel, is of the following dimensions:—Length, 80 ft.; breadth, 43 ft.; depth amidships, 12 ft. The vessel is subdivided into thirteen watertight compartments by longitudinal and transverse iron bulkheads. The main deck is iron, and under it accommodation is provided for the crew. Its distinctive feature is an elevating deck platform, which extends the whole length of the vessel, and occupies two-thirds of its width. This platform is supported by six steel columns of box-section, and from its lowest position can be raised to a maximum height of 15 ft., by means of six large steel screws placed inside the upright columns. By means of this deck platform vehicles and passengers may embark and land on the quay or landing place irrespective of the rise and fall of the tide. When the tide is low the elevating deck is raised, and as the tide rises it is lowered. The vessel has accommodation for about 300 passengers, besides eight loaded carts and horses, or the same number of passengers and four loaded lorries and three loaded carts and horses, or, if passengers only, 600 to 700. For the transportation of railway carriages and waggons two lines of steel rails are laid on the part of the platform set apart for the vehicular traffic. The passenger accommodation is upon each side of the elevating platform, and the vehicles and goods occupy the central part of the platform.

The propelling and elevating machinery is located amidships, and consists of two independent sets of surface-condensing three-cylinder engines of about 320 I.H.P. collectively, each set coupled with its own line of propeller shafting, and each shaft carrying two propellers. Steam steering gear is fitted on the upper bridge, and also on main deck, while Brown's patent steam and hydraulic starting and reversing gear is fitted to the propelling engines. In the event of either set of engines being disabled, provision has been made for the remaining set to propel the vessel. Steam is supplied by two horizontal boilers of Siemens-Martin steel constructed to Board of Trade requirements, for 150 lbs. working pressure. The air and circulating feed and bilge pumps are worked independently of the main engines. The engines for raising and lowering the platform are also separate, but are similar to those for propelling, and are supplied with steam from same boilers. The elevating engines drive two lines of horizontal shafting, running fore and aft. On the shafting, steel gun-metal gearing is fitted to drive the elevating screws for raising and lowering the platform.



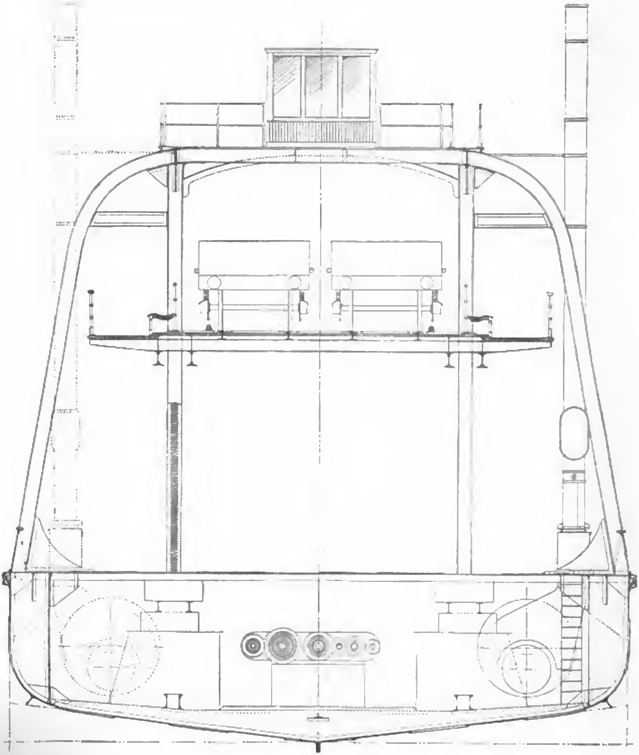
THE ELEVATING FERRY STEAMER "FINNIESTON."
CONSTRUCTED FOR THE CLYDE TRUSTEES BY MESSRS. WM. SIMONS & CO., RENFREW.—(*See page* 297.)



PATENT ELEVATING FERRY STEAMER "FINNIESTON."
CONSTRUCTED FOR THE CLYDE TRUSTEES BY MESSRS. WM. SIMONS & CO., RENFREW.—(*See page* 297.)

This gearing is so designed that a variation of speed can be obtained as the nature and extent of the load may require.

Besides the rapidity and economy in transportation of goods, passengers, vehicles, &c., with such a ferry steamer, inclined slips and approaches are dispensed rith, thus diminishing the tear and wear of carriages nd horses on the incline. There is also an important onsideration which the crowded state of Glasgow **harbour renders of peculiar moment, which is that a vessel of this type is not confined to one special berth, but, if necessary, can proceed to another point of debarkation.**



Midship Section.—Patent Elevating Ferry Steamer, "Finnieston."—*(For description see page 297).*

The Clyde Trustees are to be congratulated on the fact that, if they have been slow in coming to a decision in this matter, their choice in the end has proved a wise one. During the five weeks, each of six days, ending August 30th, the *Finnieston* carried 12,512 vehicles, yielding a revenue of £153 14s. 8d. and 150,325 passengers, paying £269 13s. 8½d.: together £423 8s. 4½d. Since the ferry was put on, fares for vehicles have been reduced 25 per cent. It will thus be seen that this huge floating bridge, while it secures the minimum of interruption to the ordinary river and harbour navigation, is unquestionably proving an immense boon to all classes of the population on both sides of the river, and it goes a long way toward solving the problem of cross-river communication for a good many years to come. The whole of the work connected with this new ferry has been completed under the superintendence of Mr. James Deas, M.I.C.E., engineer to the Clyde Trustees, and Mr. R. H. Robson.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from August 26th to September 25th, 1890:—

Agnew, John W., engineer to the *Peacock*, to date September 12th.

Allen, Wm. T., chief engineer to the *Howe*, to date September 18th.

Apps, Wm. R., engineer to the *Latona*, to date September 12th.

Aston, Saml., engineer to the *Asia*, additional, to date September 8th.

Barns, Benjamin J., chief engineer to the *Tartar*, to date September 2nd.

Barker, Robt. J., staff engineer to the *Marathon*, to date September 16th.

Bennett, Jas. M. C., chief engineer to the *Polyphemus*, undated.

Bennington, John W., chief engineer to the *Andromache*, to date September 2nd.

Bissaker, Alfred E., probationary assistant engineer to the *Asia*, supernumary, to date September 15th.

Broadbent, Charles, assistant engineer to the *Marathon*, to date September 16th.

Collingwood, Richd., engineer to the *Ringdove*, to date September 16th.

Comley, Edwin J., fleet engineer to the *Howe*, to date September 15th.

Cottam, Fredk. M., engineer to the *Garnet*, to date September 6th.

Dawson, Fredk. G., assistant engineer to the *Edinburgh*, to date September 6th.

Edgar, Edward J., engineer to the *Pembroke*, additional, to date September 6th.

Emdin, Archie R., assistant engineer to the *Malabar*, to date August 27th.

Faulkener, Percy F., engineer to the *Edinburgh*, to date September 6th.

Follett, Saml. G., chief engineer to the *Tamar*, to date September 3rd.

Ford, Francis, staff engineer to the *Edinburgh*.

Goodhall, Geo. G., assistant engineer to the *Volage*, to date September 6th.

Jackson, Thomas P., assistant engineer to the *Edinburgh*, undated.

Jeffery, Edwin J., chief engineer to the *Garnet*, to date September 6th.

Johns, Arthur J., engineer to the *Spider*, to date September 2nd.

Kerr, John, acting chief engineer to the *Sphinx*, to date September 6th.

Kingston, Fredk. J., engineer to the *Jackal*, to date September 8th.

Knight, Geo. G., engineer to the *Pembroke*, additional, to date September 6th.

Lancashire, Jos. E., assistant engineer to the *Polyphemus*, to date September 6th.

Littlewood, Alf. W., assistant engineer to the *Marathon*, to date September 16th.

Mitchell, Fredk., chief engineer to the *Dolphin*, undated.

Moon, Henry J. J. G., chief engineer to the *Hotspur*, to date September 6th.

Moorhead, John E., probationary assistant engineer to the *Serapis*, to date August 26th.

Morris, Owen A., probationary assistant engineer to the *Iron Duke*, to date September 6th.

Pill, Jos. H., engineer to the *Asia*, additional, to date September 8th.

Read, Alfred T. P., probationary assistant engineer to the *Tamar*, to date September 6th.

Roffey, James R., assistant engineer to the *Crocodile*, to date August 27th.

Roome, Geo. W., assistant engineer to the *Euphrates*, to date September 15th.

Ryan, Wm., engineer to the *Marathon*, to date September 13th.

Shorey, Chas. E., engineer to the *Polyphemus*, undated.

Slade, John H., chief engineer to the *Tyne*.

Stephens, Lindsay J., assistant engineer to the *Howe*, to date September 3rd.

Stewart, Chas. E., chief engineer to the *Sappho*, to date September 2nd.

Storey, Charles E., engineer to the *Medea*, to date September 15th.

Thompson, Geo. F., probationary assistant engineer, to the *Edinburgh*, to date September 6th.

Tompkins, Albert E., engineer to to the *Inflexible*, to date September 15th.

Toop, Henry, assistant engineer to the *Polyphemus*, to date September 6th.

Underhill, Charles, chief engineer to the *Caroline*, reappointed on promotion, to date August 9th.

Vining, Henry P., engineer to the *Indus*, additional, to date September 2nd.

Wheeler, Richd. G., fleet engineer to the *Edgar*, to date September 3rd.

Wiggins, William T., engineer to the *Lapwing*, to date September 16th.

Wishart, Wm. L., chief engineer to the *Asia*, additional, to date August 25th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, Sept. 20th, 1890.

TEAK.—The deliveries for the past three weeks are 1,014 loads. These figures will be largely increased by the end of the month, on account of considerable deliveries at present in progress, and will show a very satisfactory total. As the landings have been *nil*, this leaves a decrease in the stock of something like 1,400 loads. A large proportion of the stock still consists of inferior wood, the quantity of good merchantable timber being very moderate. If the character of the stock generally were better, a recovery in prices might be legitimately counted upon, from the fact that the amount of tonnage afloat is much less than has been known for some considerable time. The f.o.b. cost of teak having been enhanced some 25 per cent. through the rise in the value of the rupee, and, in addition, freights being firmer, will no doubt have great influence with shippers in arranging future business.

Shipbuilders who have been withholding their orders for some time have now given out their inquiries, and when their requirements are satisfied, the market will have assumed a much more settled appearance than has been known for the last twelve months.

MAHOGANY.—There has been for some time a great scarcity of really good timber, available for general purposes, as the demand for this class of wood to complete contracts has absorbed most of that offered for sale. The trade, having let their stocks run low, are now eager to purchase, and this has caused a considerable rise in prices, which is likely to be maintained for some time, as stocks are very small and the demands of merchants and dealers are sufficient to absorb the three cargoes now being prepared for sale.

The deliveries have been large during the month, and extensive consignments are expected to be made to H.M. Dockyards, early next month.

Of Cuba and St. Domingo there is still an abundance, and for the present the market is extremely dull, but with the expected continued rise in other varieties, there is likely to be a reaction very shortly.

CEDAR.—Nothing of any importance has taken place during the month, and prices are weak for cigar-box wood. The trade are much in want of good stocks, especially for boat-building purposes.

American Sawn Walnut, Whitewood, &c.—Trade has somewhat fallen off during the last few weeks, but prices for good qualities are being maintained, and fair average parcels find ready customers. The disturbing feature is the large collection of third and fourth qualities, which fail to find buyers. As is usual in these cases a heavy Christmas "Without Reserve" Auction will most likely take place, to the great detriment of market prices.

Walnut Logs.—Some good transactions are reported, especially in large timber, and very fair prices have been obtained. Small inferior logs are not commanding a good market.

Oak is quiet, and values have not moved.

Greenheart.— The stock is very low and quietness prevails.

Paddouk.—The demand has received a check, and nothing much is reported to be doing this month.

Kawrie Pine.—There are only small sales being made at present, and prices are easier.

Sequoia.—A cargo has arrived lately which will meet the demand which has shown itself during the past month or two, and prices are expected to be good.

The improved tone, in general, points to much better and more profitable business.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

The improvement referred to in our last month's Notes as having set in so auspiciously in Clyde shipbuilding and engineering affairs has unhappily not been maintained during September; and those firms who were not successful in securing any share of the orders then plentifully given out are regarding the prospect with some concern. A very fair amount of work, however, taken all in all, is now in the hands of Clyde firms, and wages troubles have been for the nonce allayed. Coal miners and ironworks' artizans are, however, agitating for higher wages, and at the present writing several of the largest ironworks in the west of Scotland threaten to discharge their hands and damp-out their furnaces.

The steel trade has during the month been very active, and for speedy delivery of some articles slightly more money is now being paid. The Steel Company of Scotland are particularly fortunate in the orders which they have secured. At present a fair demand exists for boiler plates, while any steel for shipbuilding purposes is booked at about late rates. Steel angles realise £6 5s. to £6 7s. 6d.; ship plates, £7; and boiler plates, £7 15s. to £8. The fact of the North of England malleable iron makers having advanced their prices, and fuel being dearer here, the Scottish malleable iron makers have intimated an advance of half-a-crown on certain classes of work. The rise has been chiefly on the lower kinds of goods. Quotations for the other grades are unchanged.

Messrs. William Simons & Co., Renfrew, keep exceedingly well employed in producing their dredging specialities. Their total output of tonnage in this way will at the end of the year be very considerable. Besides the patent hopper dredger of 500 tons per hour dredging capacity, ordered from them last month by the Nicaragua Canal Co., the firm have since received an order from the Preston Corporation for three of their hopper-barges to be employed in the improvement of the River Ribble.

Messrs. Russell & Co., Port Glasgow, have just contracted to build two sailing ships for Glasgow owners. One of 1,700 tons register for Messrs. A. R. Thom & Co., and the other of about 1,400 tons for Messrs. Robert Russell & Co. This firm have now on hand eight or nine sailing vessels, besides other work.

Messrs. Caird & Co., Greenock, whose berths are empty at present, have just contracted to build and engine two steel screw steamers of about 5,000 tons each, for the Gulf Line, managed by the Greenock Steamship Co., Limited. They are for Australian trade, and are intended to have a high rate of speed.

Messrs. Fleming & Ferguson, Paisley, have been entrusted with an order from Messrs. Allan, of the Allan Line, for a large steel steam yacht, to be fitted with the firm's patent quadruple-expansion engines, which are so eminently suitable for such vessels. The engines are intended to indicate 1,000 H P, and to take steam at 200 lbs. pressure. The yacht is to be [illegible] to the design, and under the superintendence of Mr. [illegible]tson, of Glasgow.

Messrs. William Hamilton & Co., Port-Glasgow, have contracted with Messrs. Hamilton, Harvey & Co., Glasgow, to build a four-masted steel sailing ship of 2,070 tons net register, to carry about 3,500 tons deadweight.

Messrs. Robert Duncan & Co., Port-Glasgow, have secured the contract to build a saloon passenger paddle steamer for the Caledonian Steam Packet Co. The new steamer will be on somewhat similar lines to the company's highly-successful *Duchess of Hamilton*, now on the service between Ardrossan and Arran, but will not be so large as that vessel. Messrs. Rankin & Blackmore, Greenock, who have engined most of the company's new vessels, will again supply the engines. Messrs. Duncan & Co. are also preparing to lay down, in their yard, the keel of another five-masted steel sailing ship of about 2,000 tons. The vessel, which is for owners in St. John, will be a duplicate of the *Kelton*, launched some time ago by this firm for Mr. Guthrie's "Village" line of sailing ships.

The favourite Clyde river steamer *Lord of the Isles* has been sold to run on the Thames. The owners—the Glasgow and Inverary Steamboat Co.—intend building another large and powerful steamer for the carrying on of the passenger trade, which will, in all probability, be also named the *Lord of the Isles*.

Messrs. Hall, Russell & Co., of Aberdeen, early in the month booked a contract to build and engine a steamer of 4,000 tons, for Messrs. George Thompson & Co., of Aberdeen and London. This is the largest vessel ever entrusted to Messrs. Hall, Russell & Co., and indeed no single order so large has ever been placed in the hands of an Aberdeen firm. Messrs. Hall, Russell launched on September 16th the steamer *Inyoni*, of 1,900 tons net register, for Messrs. J. T. Rennie & Son, of Aberdeen and London.

At Messrs. John Scott & Co's shipyard at Kinghorn, on the Fifeshire coast, the strike among the Unionist platers, riveters, and caulkers, due to the firm having notified a reduction in wages, has now entered upon its tenth week, and the Boilermakers' Society appears determined not to allow their members to give in, while the employers seem equally determined not to yield. They have filled up the places of the platers with non-union workmen. Several squads of non-union riveters are now employed, and on the 20th September several more of these arrived from the North of England. The work, however, is considerably behind, there being five vessels in course of construction, and in consequence the firm have been compelled to dispense with the services of some of the joiners and carpenters. The remainder of the carpenters who were union men have now been brought out by the Carpenters' Society.

Early in the month Messrs. D. & W. Henderson, of Meadowside yard, Partick, launched the steel sailing ship *France*, of about 3,750 tons gross measurement, having a deadweight carrying capacity of 6,150 tons, which takes rank as the largest sailing ship afloat and perhaps the most splendidly appointed. The vessel has been built for Messrs. Ant. Dom. Bordes & Fils, of Paris and Bordeaux, whose fleet of sailing ships—mostly Clyde-built—is the largest in the world, and includes several sailing ships, the largest of their time. The *France* will be principally engaged in the nitrate trade, and every modern appliance—steam as well as hand power—has been fitted for working cargo and for managing the ship She is fitted with a double-bottom, fore and aft, for 1,000 tons water ballast, and has, in addition, deep tanks fitted amidships, which can either be used for cargo or for 1,000 tons water ballast, as required. Pumps for water ballast, steam winches for working cargo, windlass for working anchors, &c., are all supplied with steam from two steel tubular boilers, 9 ft. by 6 ft., situated in a house amidships. The vessel is being rigged as a five-masted barque, the sail area being no less than 49,000 square feet, while the principal sails and spars are worked by means of mechanical appliances on deck. The lifeboat equipment includes a steam launch. With superior accommodation for crew and passengers the *France* may well be considered the embodiment of all that is most advanced in sailing ship design and construction.

Mr. W. G. Wrench, consulting engineer, of 5, Oswald Street, Glasgow, continues to receive gratifying testimony to the value of his patent oblique-bladed propeller, which has now been most extensively adopted both at home and abroad. During the months of July and August alone Mr. Wrench executed orders for this type of propeller to the extent represented by about 7,000 I.H.P. of engines. Several of these orders were for South America and one was for the Russian Government.

Mr. David Carlaw, of Ropework Lane, Great Clyde Street, Glasgow, whose work in the way of model engines is well-known to the visitors to exhibitions—the model of the engines of the *Princess Henrietta* and *Josephine* (built by Messrs. Denny & Co., Dumbarton), shown in the present Edinburgh Exhibition, being a superb example—is having numerous inquiries for the patent launch engine (constructed on Noble's patent), which is shown at work in the machinery hall of the exhibition, and illustrated in our columns some little time ago. This is likely to become a favourite type of engine, either where steady smooth running is required or where frequent and rapid reversal is a desideratum. Mr. Carlaw's extensive works continue to be taxed to their utmost, producing the various specialities for which his firm is noted.

The Kelvinhaugh shipyard and slip-docks, long tenanted by Messrs. Aitken & Mansel, of Whiteinch, has been leased for a period to Bailie Shearer, who will carry on the works as before.

The trustees of the Clyde Navigation are at last about to make good the deficiency which has been long felt by shipbuilders and engineers in the crane accommodation at Glasgow Harbour. Hitherto there has been no crane of greater lifting capacity than 75 tons there, whereas in several large shipbuilding establishments sheerlegs of 100 and 120 tons capacity have been in use for quite a number of years, notably in Messrs. Denny Bros., Dumbarton, J. & G. Thomson, Clydebank, A. & J. Inglis, Pointhouse, and the Fairfield Shipbuilding Co., Govan. The trustees are now advertising for tenders from crane makers for the supply and erection of a steam crane of 130 tons capacity on Finnieston Quay. Tenders are invited up till Monday, 6th October.

The proposed industrial exhibition, to be held in the east end of Glasgow, from December till April, is receiving every support; and plans of the buildings and grounds have been prepared and accepted by the executive committee. Schedules for the work have been issued and operations will be begun without delay. The guarantee fund now amounts to over £9,000. A large number of exhibits have been promised, many of the most important engineering firms taking a warm personal interest in the project.

The Leith Dock Commissioners have under contemplation the desirability of forming a new dock capable of accommodating the largest kind of vessels, some of which are now occasionally to be met with in the Forth. These vessels must either wait in the roads till spring tides or discharge part of their cargoes into lighters. Two schemes have been suggested, involving (1) the reclamation of the shallow fore shores on the east side of the East Pier, and the construction of a dock to the north side of the Edinburgh Dock; and (2) the construction of a dock on the west side of the West Pier and north of the Marine Parade, involving the removal from that quarter of the shipbuilding yards. Both of these schemes, however, have been deemed too costly, and a modification of the first scheme has been prepared and it will probably be adopted. The modified scheme involves the deepening of the fairway, and under it there might be made available more dry dock accommodation, which it seems is urgently required. Half-a-million sterling is mentioned as the probable cost of the new scheme.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The renewed stimulus which was given to shipbuilding a few weeks ago, through the desire of shipowners to add to their working tonnage while prices were apparently at their lowest, has already received a check, and fewer enquiries are now forthcoming than when we last had occasion to make some observations on this subject. The fact that the price of cargo boats has risen from £7 to nearly £9 per ton is in itself sufficient to account for the falling off of enquiries; but there have been other influences helping to bring about the same result, chief among which may be mentioned the continued depression in the freight market, and the consequent growth among shipowners of a conviction that, by continuing to build on an extensive scale, they would not only depreciate the value of existing property, but would place in the hands of merchants a lever by which the latter might permanently, or for a time at all events, keep down the rates for oversea carriage of goods. The orders which were placed, however, while the spurt lasted, will keep many an establishment busy over the winter months, a result which, of course, must be subject for congratulation not only in this district, but throughout the country generally. In view of the increased work that is now to be dealt with, the shipbuilders have found it expedient to withdraw the demand for a reduction in the wages rates, which was lately put forward by them, and the first instalment of which was to have come due on October 1st. The withdrawal will, however, probably only turn out to be a brief respite for the operatives, as the question is pretty sure to be again raised in the early part of next year, and when next brought forward there is little likelihood of its being abandoned until some definite arrangement has been arrived at. The new offices of the Boilermakers' and Iron Shipbuilders' Society, which have been some months in course of erection, were formally opened on the 22nd inst., by Sir B. C. Brown, the respected head of the firm of Hawthorn, Leslie & Co., who was invited to perform the ceremony. The acquisition by the society of a building which is to serve the purpose of a residence for the general secretary as well as a place in which to transact business, is the direct outcome of a resolution arrived at some time ago, to the effect that the headquarters of the society, which were formerly removeable, should be permanently located at Newcastle. While speaking of the Boilermakers' Society, it may be stated that an edict issued last month by the executive, with reference to the abolition of night work in shipyards, has been recalled, and a cause of considerable inconvenience to shipbuilders has thus been got rid of. The Scotswood shipbuilding yard, which several months ago passed into the hands of a newly-formed company that has since been registered under the style of the Scotswood Shipbuilding Co., Limited, is now quite ready for the commencement of work, and as the material for the first vessel is ordered, it may be inferred that a start will very soon be made. Since the new company came into possession, the machinery and general working appliances of the yard have been completely overhauled, and where necessary, added to, and the establishment is now one of the most admirably appointed to be met with anywhere. That Messrs. Armstrong, Mitchell & Co. have received an accession of orders is demonstrated by the fact that keels for three vessels are being put down in the ocmpany's Low Walker yard. Messrs. Hawthorn, Leslie & Co. are also preparing three berths for the putting down of keels, and in this case it is understood that more than the ordinary number of frame-benders will be employed to expedite the earlier stages of the work. The vessels which the last-named firm are about to lay down are all passenger steamers of a high class, and it is understood that at least one of them will be of exceptionally large dimensions. Messrs. C. S. Swan & Hunter have just launched a finely designed passenger boat, built to the order of Italian owners, and they have other vessels of a similar class in progress. This firm will doubtless find themselves especially inconvenienced by the continuance of the joiners' strike, as, while it lasts, the fittings of the cabins in such vessels as that recently launched cannot be proceeded with. In this connection it may be stated that the s.s. *Hereford*, built by Messrs. Dobson and Co., for Bristol owners, has, owing to the cause mentioned, had to leave the builders' hands without her cabins being completed, and this is not the only vessel which, during the past month, has had to be sent away from the Tyne to get the necessary joiner work done elsewhere. In addition to the dispute between the shipwrights and joiners, which greatly impedes the operations of the Palmer's Shipbuilding Company, a question of difference between the platers and helpers cropped up lately at the company's yard, and has been the cause of some inconvenience, a large part of the plating work having been stopped during the six or seven days of its continuance. These conflicts between different sections of workmen are unfortunately becoming more frequent since the tendency to combine has become so prominently manifested, and it is much to be desired that some steps should be taken to prevent them, or to minimise their evil effects. Messrs. T. & W. Smith, of North Shields, have now no vessels on the stocks, and no signs are visible which would indicate the possession of any new work to begin with. There is a rumour current that the firm contemplate the erection of a pontoon dock, to occupy the site of one of their present building berths, but though a good deal has been said as to the early commencement of the work, nothing definite in this direction has yet been done. Messrs. Rennoldson of South Shields are about to lay down two paddle-steamers, each of which is to be 130 ft. in length. The firm have also several trawlers to build, and will be able to keep their yard busily going over the winter months.

Engineering.—The declaration of a dividend of 11¼ per cent. by the directors of Sir W. S. Armstrong, Mitchell & Co. has just been announced, and the incident speaks volumes for the economical management as well as the general prosperity of the works, which comprise not only shops for the manufacture of ordnance, but also blast furnaces, steel works, engineering, bridge building, and boiler shops, as well as shipbuilding premises that are, perhaps, the most extensive in the world. All the various departments are now quite busy, and the pressure of business in the steel works is so great that an immediate extension has been decided upon, which will double the productive capacity. In the marine engineering establishments briskness is still the rule, repair work and conversions of compound to triple engines forming a good proportion of the contracts in hand. The Forth Banks, as well as the St. Peter's Works of Messrs. Hawthorn, Leslie & Co., are kept exceedingly busy, there being at present in hand a large number of orders for a speciality of the firm known as the "Crane Locomotive." Some of these powerful and most useful engines have recently been despatched to Government dockyards, and to the establishments of private firms in various parts of the country; and, from the approval they are receiving wherever introduced, it may be inferred that the demand is likely to increase steadily. The dismantling of Hawks, Crawshay & Son's works is now well-nigh completed, and where once stood a mass of buildings, comprising forges, rolling mills, foundries, bridge shops, chain and anchor shops, and general engineering works, nothing is to be seen but fallen walls and piles of débris. The only exception to this general state of ruin is to be met with in the steel works, where an enterprising Sheffield firm are making arrangements for an early resumption of productive operations. It may also be stated that other portions of the extensive area covered by the partially-dismantled buildings are likely to be again utilised for manufacturing purposes. The Mica Grease Company, South Shields, have just brought out a new speciality, named "Mica Belting Syrup," which is to be applied to machine belts for the purpose of preventing them slipping from the pulleys while in motion. The company, who are doing a large trade with the well-known mica grease and packing, are certain to add substantially thereto by this new article, which, we are informed, has given the greatest satisfaction in the few instances where it has, up to the present, been introduced.

Electric Lighting.—Messrs. J. H. Holmes & Co. have just finished a complete electric lighting installation on the s.s. *Knight Commander*, built by the Palmer's Shipbuilding & Iron Co., Limited. The generating plant consists of a No. 14 "Castle" dynamo, coupled direct to a vertical engine, with 8¼ in. cylinder by 8 in. stroke, to run at 250 revolutions per minute. The dynamo is compounded for constant voltage, and the engine is fitted with Pickering's governor to maintain constant speed under varying loads. The installation, which is carried out on the single wire system, consists of 117 sixteen-candle power lamps. Cargo lanterns are provided for each hatch, and on the holds couplings are fixed, to which portable hand-lamps can be connected. The engine-room alone contains 17 lights, two being fixed under the cylinders of the main engines, and three on the face of the condenser, to light the crank, bearings, &c. Special precautions are taken to prevent overheating of the fittings or wires in these positions. The four lights in the tunnel are controlled by a switch at the entrance. On completion the whole of the installation was run for 24 hours by the contractor. Messrs. Holmes & Co. have also recently completed installations on the cargo boats, *Arab*, *Wharfe*, *Austria*, *Sea King*, *Storm King*, *Mary Beyts*, &c., &c., and also on the following petroleum steamers:—*Standard*, *Beacon Light*, *Brilliant*, *Geestemunde*, and *Heligoland*, and have erected generating plants on many other steamers, including the Norwegian passenger boat, *Britannia*, to which they also supplied a powerful "projector" for use in the fiords.

THE WEAR.

Shipbuilding.—The condition of the staple industry has improved greatly within the past few weeks, and the laying down of keels at almost every establishment on the river is conclusive evidence of the fact. The firms that have been conspicuously successful in obtaining new orders are Messrs. W. Doxford & Sons, Messrs. Osborne & Graham, and Messrs J. L. Thompson & Sons, while the Sunderland Shipbuilding Co., Messrs. Short Brothers, and Messrs. Priestman & Co. are also understood to have added substantially to their contract engagements. Messrs. Doxford have now all their available building space occupied, and they have in reserve a considerable amount of work, nearly all of which is understood to be of a first-class type. The firm have recently presented a number of splendidly finished models of vessels built by them to the committee of the local free library and museum, and these are now exhibited in the building, constituting one of its most prominent attractions. Messrs. Short Brothers launched, on the 16th inst., a fine specimen of a cargo boat, for Messrs. J. T. Lunn and Co., Newcastle. The vessel, which is nearly 300 feet long, is built to the highest class in Lloyd's registry. Among the other contracts now in hand by Messrs. Short Brothers is a sister ship to the above-mentioned vessel, and a large cargo boat for the Neptune Steam Navigation Co. Messrs. Pickersgill launched on the same day a steel sailing ship, built to the order of Belfast owners. The vessel is said to be the largest sailing ship yet built on the North-East Coast, being over 300 ft. long, and having a rigging equipment of no less than 20 steel masts and yards. The builders have another large sailing ship on the stocks, and these are not the only vessels of the kind building on the river, as a neighbouring firm have just put down the keel for a sailer of the very largest class. Mr. James Laing has four vessels on the stocks, and two in the river being fitted out. The same builder has, during the past month, had a good deal of repair work in hand, and both the graving docks have been kept pretty constantly occupied. Operations at the Sunderland Shipbuilding Co.'s yard have been a good deal impeded through the delivery of material being delayed, and at one or two other establishments impediments of a similar kind have caused much disappointment to both employers and workmen.

Engineering.—At the Palmer's Hill Works business continues very active, a large portion of the machinery being kept going night and day. The extension of the quay is being proceeded with, and when it is completed this establishment will be provided with quay space of quite exceptional extent. There is a well-sustained demand for Dickenson's patent crank shaft, and a considerable number of these specialities have been turned out lately. Messrs. Doxford & Sons have several large contracts in progress, and some others of an equally important kind are yet to be commenced with. Messrs. Clark are also well supplied with orders, and the North-Eastern Engineering Co. have as much work in hand as they can conveniently deal with. Manufacturers of steam winches, steering gears, &c., continue to be kept briskly going, and the forges and ironworks are busier than they were a month ago. Iron and brass founders are still fully supplied with work, and coppersmiths are in an equally satisfactory position. The strike of miners at Monkwearmouth Colliery has at length been settled on the basis of the terms agreed to generally throughout the county, and the men have resumed work. It is stated that the privilege of stopping work at noon on Saturdays, instead of at one o'clock as hitherto, has been extended to the colliery mechanics throughout the county of Durham.

The Hartlepools.—Since last month several orders have been booked by Hartlepool shipbuilders, and at Messrs. Gray and Co.'s yards all the berths are now occupied. In the repairing line the same firm are well supplied with work. Messrs. Whitby & Co. have three large steamers on the stocks, and the prospect of a good winter's work is assured. Messrs. Richardson & Co.'s establishment is quite full of work, and the department which has been specially devoted to the manufacture of Morison's Combination Evaporator is especially brisk, the demand for that speciality being fully maintained. At the Central Marine Works continued activity exists, and in several departments the machinery is kept going night and day. Timber imports being still large, and coal shipments up to the average, the business aspect of the docks may be described as satisfactory.

Stockton.—The whole of the shipbuilding yards at this centre keep busy, and in the boiler shops and bridge yards there is generally a fair amount of work going on. Since August 22nd the following steamers, engined by Messrs. Blair & Co., have had their trial trips:—The s.s. *Danby*, built by Messrs. Ropner & Son, of Stockton, for Messrs. Merryweather & Co., of West Hartlepool, having engines of 160 H.P., with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. The s.s. *Forth*, an old vessel owned by Messrs. J. M. Lennard & Sons, of Middlesbro', having new engines of 80 H.P., with cylinders 15 in., 25 in., and 40 in. by 30 in. stroke. The s.s. *Rockabill*, built by Messrs. Raylton, Dixon & Co., of Middlesbro', for Messrs. Farrel, Groves & Co., of London, having engines of 175H.P., with cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The *s.s. Congo*, built by Messrs. Richardson, Duck & Co., of Stockton, for Messrs. Thomas Wilson, Sons & Co., of Hull, having engines of 200 H.P. with cylinders 22½ in., 37 in., and 61 in. by 42 in. stroke. The *s.s. Hero*, built by Messrs. Raylton, Dixon & Co. for Messrs. the Bristol Steam Navigation Co., Limited, having engines of 90 H.P. with cylinders 16¼ in., 27 in., and 44 in. by 30 in. stroke. The whole of these engines were constructed to work at 160 lbs. steam pressure, and on their trials gave complete satisfaction.

Middlesbro'.—In the shipbuilding yards there is still considerable activity, repair contracts forming a large part of the work in hand. Engineering works are still fairly busy, and in the foundries and steel works orders are plentiful.

Darlington.—The Darlington Forge Co.'s Works continue to be fully employed, and there is a prospect that this satisfactory state of matters will be maintained for some months longer.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—There is a much more active trade doing in shipbuilding than has been experienced for a considerable time past. A better inquiry has sprung up for shipping, as well on home as on foreign account, and it is obvious that several owners of shipping, who have been keeping back their orders are now disposed to place them, before material advances in price to any prejudicial extent takes place. Business has been transacted on a large scale during the month, and there is still a good inquiry. The Naval Construction and Armaments Co. at Barrow have received five orders during the month. Firstly, they have been entrusted with the contract to build a powerful dredger for the European Commission of the Danube; secondly, they have secured orders for two 3,000 ton steamers for the British and African Steam Navigation Co., fitted for passengers and cargo; thirdly, they have booked an order for a 3,000 ton steamer for the West Indian and Pacific Steam Navigation Co., of Liverpool,—length, 318 ft., breadth, 40 ft., and depth of hold, 28 ft.; and fourthly, they have secured from their old clients, Messrs. Elder, Dempster & Co., of Liverpool, the order to build a small steamer. This company has previously built steamers for Messrs. Elder, Dempster & Co., and for the British and African Co., and they have also constructed dredging plant for the European Commission of the Danube. The West Indian and Pacific Co. are new clients, but this first order is not likely to be the last. It is satisfactory to note that the orders recently booked by the Naval Construction and Armaments Co. are intended to tide over a short interval pending other important work under consideration. Mr. Bryce-Douglas, the managing director of the yard, has gone to America, in the Cunard steamer *Umbria*, which was engined by himself, on a business visit which it is hoped will introduce some very good orders to the Barrow Co. In the meantime all the departments in the yard are very busy and likely to remain so. In a few days the Company will have eight vessels on the stocks and they have three in the docks already launched, which are being fitted with engines and equipped for sea, representing in the aggregate 40,000 tons. In addition to these ships they are tripling two large steamers. The engineering department is especially brisk at Barrow, and the shops are working night and day with two shifts of men. This activity is likely to be continued for a considerable time to come.

Whitehaven.—Some hopes are at length entertained of the prospect of leasing or disposing of the shipbuilding yard at Whitehaven, which has been closed for some time. Captain Jacques, one of the directors of the Whitehaven Shipbuilding Co., visited the Manchester Ship Canal works a few weeks ago in company with representatives of most of the shipbuilding firms in the country. He introduced the subject of the Whitehaven yard to several shipbuilders with the result that Messrs. Gilchrist & Co., engineers of Liverpool, have visited the place with a view to resuscitating the concern. This company contemplate, if they arrange to take over the works—which is thought very likely—to build ships at Whitehaven and fit them with engines at Liverpool. They are sanguine if they carry out the arrangement that they can secure plenty of orders The people of Whitehaven are very anxious, naturally, that the scheme shall be realised, and the directors of the Whitehaven shipyard will not leave any stone unturned with the view of leasing or disposing of the works.

Preston.—Application has been made to the Ribble Committee for a plot of land, 2,000 square yards in extent, with the view of erecting a large engineering works on the quay of the new docks.

The Steel Shipbuilding Material Trade.—A great improvement has taken place in the steel shipbuilding material trade of the North-West of England during the month. Makers, previously, were well supplied with orders, and were enabled to keep their works busy, but there was not a good outlook for the future. A revival has however set in, and there is a brisk demand for plates, which are selling at £6 12s. 6d, and for angles which are quoted at £6 per ton. Other sections are in good request, and steel boiler plates which have been largely ordered are quoted at £8 per ton. A brisk trade in this department is now assumed for another year or eighteen months, and probably before that time has expired the producing plant will be increased by the erection of several new mills.

THE MERSEY.

DURING the past month there have been decidedly more inquiries coming into the hands of shipbuilders on the Mersey. Although these do not result in much actual work being secured, they may be taken as an indication that there is a fair amount of work to be given out, and this is certainly an improvement upon the almost complete absence of inquiry which has been the general complaint for the greater portion of the present year. For the most part, however, where new work is actually offered, it is based upon prices so excessively low that shipbuilders are altogether unable to entertain it, and where open inquiries are put forward the tenders which shipbuilders send in apparently do not meet the views of their customers. Certainly, the prices which shipbuilders quote do not result in orders being placed, and the inquiries would seem for the present to be more in the nature of "feelers," with a view of testing how low prices can be brought. No doubt the recent hardening in the various descriptions of raw material has had something to do in bringing forward these inquiries, but evidently those who are in a position to give out new vessels are not satisfied that the prices which shipbuilders are quoting have touched their lowest point, and work is consequently still being held back. On the other hand, shipbuilders, in view of the continued unreasonable attitude taken by the men, are compelled to be very cautious in entering into further contracts. The men show no disposition whatever to take into consideration the altered conditions of trade, or to make any allowance for the difficult position in which employers have recently been placed. The recent edict issued by the Iron Shipbuilders' Society that apprentices are no longer to be employed on repair jobs, is an illustration of the unreasonable restrictions which they are still determined to put upon trade, all having the inevitable result of enhancing the cost of production. So far no definite action has been taken by the employers on the Mersey with reference to this last step on the part of the workmen; indeed, Messrs. Laird & Co., of Birkenhead, who are chiefly affected by the restriction, are too busy with Government and other work to enter into conflicts with the men on every fresh demand which they put forward, and the men are not slow to take every advantage of this position of affairs by extorting in one shape or another, higher wages from Messrs. Laird & Co. than they are being paid in any other shipyard in the neighbourhood. Another movement which has been taken by the Iron Shipbuilders' Society, has been to stop all overtime upon new work, and this restriction is being rigidly enforced to the very considerable inconvenience of shipbuilders, in some instances, the launch of a new vessel from one of the yards having been delayed for a couple of months in consequence. This stoppage of overtime has no doubt been adopted as a counter move to the threatened reduction of wages on the Clyde, as well as to prevent any attempt at reducing wages elsewhere, and it is being enforced throughout the various shipbuilding centres of the country. Although the outlook of the shipbuilding trade is more satisfactory than it has been for some months past, the unsettled feeling with regard to possible labour and wages troubles tends to very seriously check the development of actual business from the increased inquiries which are coming forward. Shipbuilders are compelled to protect themselves against eventualities by imposing conditions and quoting prices which are evidently preventing the placing out of orders, and even the advantage which they now possess of low-priced raw material, so far from helping them, tends only to increase the difficulty of their position. The reduction which has taken place in the price of iron and steel is more than fully discounted by customers who have work to give out, and they seem to expect that the price of a new vessel should be reduced all round to a corresponding extent, ignoring the fact entirely that wages have not given way in the least, but that rather further demands and restrictions of one sort or another are constantly being put forward by the men which all add very materially to the cost of building. Whether the inquiries now coming npon the market indicate a revival in trade, sufficient to overcome all the present difficulties of the situation, remains to be seen, but if the present promise of some return to activity is barren of results, the fault will most assuredly lie at the doors of the workmen and of the Trades' Union Societies, by whom their actions are now governed in such a manner as to be most detrimental to the true interests of trade as affecting not only the employers but also the employed.

Messrs. Laird & Co., of Birkenhead, as already stated, continue very busy with Government and other work, and they report a decidedly increased weight of inquiries with a fair amount of new work having been placed. In fact, it would seem that a good deal of work could no doubt be secured if shipbuilders were prepared to accept the low prices which are offered. In another column we give full particulars of a new steamer, the *Ottoman*, launched during the past month by the firm for the British and North Atlantic Steam Navigation Co. Messrs. Laird have just commenced upon another new steamer for the Great Western Railway Co., and intended for the Channel Islands service. This steamer is an improved and enlarged edition of the three vessels, the *Lynx*, the *Antelope*, and the *Gazelle*, built last year for the Great Western Railway Co. Another vessel in hand also for the above Company is a mail and passenger tender for Plymouth. The vessel for the Channel Islands service is a powerful steamer designed for high speed; the tender is something like the Cunard tenders on the Mersey, but rather smaller. Good progress is being made with the line-of-battle ship for the British Government, and trials continue to be made with the torpedo boats recently launched. Messrs. Thomas Royden & Son, although they report a considerable number of new inquiries, have not booked any new work since our last report and are still simply working completing the vessels they have on the stocks. Messrs. W. H. Potter & Sons have just completed a large steel four-masted sailing ship named the *Dunfermline*, of 2,800 tons register, intended for ordinary cargo trade. This vessel has been built for McVicar, Marshall & Co., of Liverpool, and is the third boat of the same design which they have built for the above firm. Messrs. Potter are now laying down a large sailing ship of about 3,000 tons register, which they are building upon their own account. The reports received from the above firm are much the same as in other cases. There are a number of new inquiries stirring, but so far, none of these result in any actually new work being secured.

Marine engineers report that during the past month there has been very little new work going out, and that, in most cases, they are simply completing orders they have already on their books. Of course a great deal will depend as to whether the inquiries now coming forward for new ships will result in orders being placed with shipbuilders on the Mersey, as to the position in which marine engineering firms will be placed for next year.

Boilermakers are fairly busy; the complaint, however, of most of them is that new work now offering is so much cut down in price that it is very difficult to secure work which is at all of a very remunerative character. In a great many instances the orders are only offered at prices which are so excessively low that boilermakers are compelled to allow them to pass.

With regard to the condition of the engineering trades, as shown in the reports issued by the workmen's organizations, there is some slight increase in the number of unemployed returned from the Lancashire shipbuilding centres; but this seems to be due more to the stoppage of night shifts, as the result of the action taken by the Iron Shipbuilders' Society referred to above, than to any present lessened demand for labour. From personal conversation with some of the leaders in connection with the men's organizations, it may be added that the unreasonable attitude which has been of late taken by the men is being viewed with no little dismay. Those who think at all seriously over the matter do not fail to appreciate the possibility of retaliation on the part of the employers which such course of action may bring about, when lessening activity in trade destroys the present strong position occupied by the men. The course of action adopted by the "new unionism," as represented by the recently formed Dockers' Union, is also a matter which gives rise to very serious apprehensions with regard to the future. The "new unionism," although undoubtedly represented by numbers, is deficient in funds to enable it to withstand any serious depression in trade, and fears are entertained that the troubles in the future which may possibly result from the reckless course of procedure adopted of late at several of the seaports may not only involve those who have been directly responsible, but that other workmen's organizations which have practically taken no part or lot in these movements may suffer not only equally, but probably to a still greater extent. The recent Trades' Union Congress at Liverpool demonstrated the wide divergence of views between what are now termed the "old" and the "new unionism," and certainly the old-established organizations have no sympathy with the wild and ill-considered projects which the representatives of the new movement are setting on foot. The new organizations which have recently sprung into existence are regarded as a source of weakness to trades unionism generally, as aiming to set on foot projects which they have no strength to carry out, whilst in the event of any serious depression of trade requiring support for the protection of the legitimate interests of the men, they would not only be unable to render any assistance whatever, but would in all probability be quickly swept away owing to their financial weakness and want of solid organization.

In the iron and steel trades there has been again a strong upward movement in prices during the past month, but this, as pointed out in our previous report, has been due more to labour difficulties than increased actual demand. The latest development of labour questions has been the threatened dispute with the blast furnacemen on the Clyde and the damping-down of the furnaces, which has caused a rapid npward movement in warrants both at Glasgow and Middlesbro', with a consequent hardening up of prices in this district. Although buyers show little or no disposition to follow the advanced rates, the present inflation of prices being regarded as simply temporary there has been decidedly more anxiety to place out orders where buyers have been found willing to accept anything like late rates. The conviction is certainly growing that although the advance, based upon the present labour difficulties in Scotland, is not likely to be maintained, there is not much probability that makers' prices will recede to any material extent below the rates which have recently been current. The general ontlook in the principal iron using branches of industry is certainly more hopeful than it was a short time back. In many departments new work is coming forward more freely, and there are no present indications of any early approaching slackness in trade. Consequently there is every prospect of continued large requirements for iron and steel for actual consumption, which of itself must help to keep up prices, whilst the unsettled outlook with regard to labour and wages questions is a further element which must prevent any downward movement. Producers, both of raw and manufactured iron, are of necessity being compelled to exercise great caution in entering into forward contracts, and certainly they are not disposed to commit themselves to engagements at under current rates.

For pig-iron, apart from the fluctuations in warrants, there has been a steady hardening up in prices. Lancashire makers are now very firm at 50s. to 51s. less than for forge and foundry qualities delivered in the Manchester district, and they are booking moderate orders at these figures. In district brands quotations for Derbyshire have advanced to 51s. and 53s. for the cheaper forge and foundry qualities up to 56s. for the best foundry brands less 2½ delivered, whilst for Lincolnshire, makers who in most cases are indifferent about selling, owing to prospective difficulties in obtaining supplies of coke, are not quoting under 50s. for forge, to 52s. and 53s. for foundry, less 2½ delivered here. Outside brands are necessarily so much affected by the movement in warrants, that it is difficult to give any really fixed prices for these, but the latest quotations are firm at about 57s. 4d. for Middlesbro', and 59s. to 59s. 6d. for Eglinton, net cash delivered equal to Manchester.

In manufactured iron there has been a steadily increasing weight of business during the month, with a hardening up in prices, especially for hoops and sheets. Ordinary descriptions of bars delivered in the Manchester district are not now quoted under £6 10s.; hoops in some instances have been advanced to £7, and sheets are firm at £8 per ton.

In both raw and manufactured steel there has been a very considerable advance in prices. Good foundry hematites, with the close of the month, are quoted at about 68s. per ton, less 2½ delivered in the Manchester district, but only a moderate business has been done; in billets, business has been done at prices ranging from £5 5s. to £5 7s. 6d. delivered in the Manchester district. Steel plates, both for shipbuilding and boiler-making purposes, have shown a very material advance, the leading makers quoting £7 12s. 6d. for steel ship plates, and £6 15s. for angles and bars delivered ex-steamer Liverpool. These prices, however, so far have been little more than nominal, and the demand has been very limited, shipbuilders in most cases still working on with their contracts, and not caring to give out orders at the prices above quoted. Makers of steel plates, however, in anticipation of labour troubles, are very chary about making further contracts, and although there are sellers in the open market at under the prices above quoted, the principal makers are not disposed to entertain business except at their full rates. For steel boiler plates it is now only in very exceptional cases that makers are to be found who are quoting £8 5s. per ton for delivery to consumers in the neighbourhood of Manchester. This price has been altogether withdrawn by the Scotch houses, and local makers are very indifferent about booking further orders at the above figure, whilst the cheaper plates from the Barrow district, which were offering at under £8 per ton, have been advanced between 10s. and 15s. per ton, and £8 7s. 6d. to £8 10s. per ton is now a very common quotation.

In the metal market there has been a continued strong upward movement in all descriptions of raw material, with an active demand for the various descriptions of manufactured goods, which, although they have not been officially advanced so far as list rates are concerned, show a decided hardening tendency.

In the timber trade the arrivals from British North America continue considerably under those of last year, but notwithstanding moderate imports of most articles and fairly satisfactory deliveries, the business doing remains without animation, and a great want of confidence still exists. There is little change to report in values, although in a few instances prices have slightly declined.

Business in the coal trade has been steady, but prices in all cases have not been maintained at the advanced rates which were being quoted at the commencement of the month. Supplies of all descriptions of round coal have been ample, and steam coals, delivered at the High Level, Liverpool, or the Garston Docks, have averaged about 10s. 3d. to 10s. 9d. per ton, at which figures prices remain about stationary with the close of the month.

WELSH NOTES.

THE trade of the port of Cardiff continues very brisk. In the steel trade a good deal of substantial work is being done, and strong encouragement is being given to keep the stocks of ore complete. This week large cargoes came in for Blaenavon and Cyfarthfa from Bilbao, and a good run may now be expected until the winter season sets in, especially as the friction at the docks has lessened. The iron and steel trades have had a firmer tendency. The following are the quotations:—Hematite pigs, 62s.; Siemens tinplate bars, £6 2s. 6d.; ferro 80 per cent., £13; spiegel. £5 2s. 6d.; iron ore, 14s. Freights were firmer. The coal trade continues in a most prosperous condition, notwithstanding recent heavy shipments. Steam qualities remain extremely scarce, and as a consequence prices have an upward tendency. Best qualities ruled very firm at 15s. 6d. to 16s. Good dry coals were selling at 14s. to 14s. 6d., and inferior sorts at 13s. 6d to 13s. 9d. Patent fuel was in good demand at 14s. 3d. to 14s. 6d., and an average business was done in house coals at the following prices:—No. 3 Rhondda, 14s.; No. 2, 12s. 3d. to 12s. 6d.; through, 10s. 6d.; and small, 7s. 6d. per ton. The improvement in pitwood was maintained, good wood selling at 17s. to 17s. 3d. Iron ore was also in good demand at last figures. The continuous and steady growth of the trade of Swansea is being maintained in a most satisfactory manner. An increase is shown of imports and exports, the trade in both branches having been above the average. The imports have again been large. Tinplate makers are heavily booked and chary of quoting. Prices are very firm, and pending the result of the United States Tariff Bill likely to remain so. In New York the demand for tinplates is better, and prices are higher and steady. There has been considerable activity in the metal market, with, in most instances, an advance in price.

The steel works from Landore to Blaenavon are in capital form, and at night, in whatever direction the traveller goes, the "pyrotechnic scene" is like a revival of the old days of prosperous iron making.

Every one of the industries is in fair harmony with this satisfactory state of the steel trade, and it is gratifying to add that labour and wages questions are quieting down. There is still the small coal dispute ahead, which may give trouble in the coal trade, especially as coal owners are appealing against the decision of Judge Owen, who ruled that small coal should be paid for. But it will be well not to anticipate trouble, especially as conciliation schemes are coming to the front, and the tendency is more for arbitration than fighting. Another conciliation scheme, a rival measure, it is understood, to that of Sir W. T. Lewis, is promised. Sir William's continues to grow in favour, and even the provident clause is meeting with more support. If Sir William can get his scheme into practical acceptance he will attain a high position amongst successful peacemakers, his coal scale having had sixteen years' prosperous results both to employers and men. The employers have met and discussed the measure, and now the workers are doing the same. An important coal company has been floated at Glynneath, the Davis Rhondda, Merthyr, with a capital of £100,000. Another large one in Monmouthshire is also said to be advancing. Dowlais new sinking continues to make good headway, and the deep sinking of Pwllypant progresses. This is a formidable undertaking, but is in good hands, and with ample capital at the back. It is a question of time, the results being certain.

BELFAST TRADE NOTES.

FOR the past month the shipyards have been giving signs that trade is not so brisk as it was, and there is already a considerable falling off in the number of hands employed. Although there is a fair tonnage on the stocks, it does not compare favourably with that of the first few months of the year, and the number of orders in hand is much below the average. A few orders were booked during the past month, but at prices which cannot be remunerative at the present prices of labour and material. Up to the present there has been no notice given of any reduction of wages. Boiler makers are at present fairly well employed, and the work in hand is quite up to the average. Engine shops are fairly busy, and, as some of the shipbuilders who do not construct their own engines have lately been having a good deal of their work done in Belfast, the general trade has greatly improved. There are at present several good export orders for machinery in hand. The agitation among the coal porters and quay hands causes much inconvenience. Some advances are now being made by the men, and it is thought that the strike will not continue much longer. The feeling, however, is spreading to other branches of industry.

LEITH NOTES.

DURING the past month a large amount of new tonnage has been launched on the east coast, and the work on hand at the various yards promises well for the next six months, though inquiries for new work are conspicuous by their absence.

At Aberdeen Messrs. Hall, Russell & Co. launched a steamer with a gross tonnage of 1,900 tons, and Messrs. Duthie, Sons & Co. launched a "well-decked" steamer of 1,708 tons gross. Both of these are for Aberdeen owners. At Dundee Messrs. Gourlay Brothers launched a steamer of 1,600 tons gross for the Adelaide Steamship Co. At Leith Messrs. Ramage & Ferguson launched their 100th vessel, a composite steam yacht for Mr. Ernest J. Wythes, of the Royal Yacht Squadron, and Messrs. S. & H. Morton & Co. launched an awning-deck steamer 216 ft. long for Norwegian owners. While at Alloa the Grangemouth Dockyard Co. launched a large steel sailing-ship of 2,550 tons deadweight capacity for Hamburg owners.

Messrs Ramage & Ferguson, Leith, have at present on hand a yacht of 600 tons Y.M., with engines to indicate 800 H.P., and a fast steamer 180 ft. long for the Royal Mail Co., both of which will be launched this year. A sailing ship 2,750 tons register for Messrs. Gardiner, of Liverpool, a steamer of 2,000 tons deadweight for Messrs. Wm. Thomson & Co., Leith, and a yacht of 1,000 tons Y.M., which will be the largest private yacht yet built in this country. Messrs. S. & H. Morton & Co. have two vessels on hand and have received an order for two hopper barges for the River Ribble Commissioners.

Messrs. Hawthorns & Co. have a large trawler and a twin-screw steamer for the Government on hand, and are about to lay the keel for a small coasting steamer.

The Grangemouth Dockyard Co., Grangemouth and Alloa, who are still very busy, are at present fitting out the *Orbis*, a steel barque of 1,600 tons register, and her sister ship, the *Emin Pasha*, both for Messrs. Evers & Classen, of Hamburg.

They have also on hand one 2,200-ton deadweight steamer for Messrs. Whylie, of Troon; two 1,000-ton steamers for a

Christiania firm; one 1,200-ton deadweight steel barque for Mr. A. O. Lindivg, Kragero; one 1,000-ton passenger and cargo steamer for Messrs. Jeus, Meinichs & Co., Christiania, for their Grangemouth and Christiania line, also a 600-ton fish steamer for the same firm, and they have still to lay down a 1,200-ton cargo and passenger steamer for Brazil, and a 2,000-ton steel barque for Mr. Ugland, of Arundal, Norway.

Messrs. Hall, Russell & Co. have received the contract for a 4,500 gross register steamer for the White Star line, the cost of which will be between £60,000 and £70,000.

The Galloway Steam Packet Co. are contemplating an addition to their fleet of a large and swift saloon steamer for their long trips.

The coal trade of Leith has been rather depressed during the past month, but a change is expected to take place very soon. The Mid and East Lothian miners made a demand of a rise of one shilling per diem, which the masters have been compelled to refuse owing to the depressed state of the markets.

BLANCHE.—On September 17th the cruiser *Blanche* went out from Devonport for her four hours' full-speed trial of her engines. The trial is reported to have been very satisfactory, the vessel maintaining a speed of 16 knots.

SKIPJACK.—On September 17th the new first-class torpedo gun-vessel *Skipjack*, 2,735 tons, 4,500 H.P., left Sheerness for the full-power official trial of her machinery, under the superintendence of the engineering officials of Chatham Dockyard and the Medway Steam Reserve. The trial was of four hours' duration, and the engines and boilers worked exceedingly well throughout. The average speed attained was 19·1 knots. The *Skipjack* returns to Chatham to be completed for sea.

ELECTRIC LIGHT INSTALLATIONS.—Messrs. Ernest Scott & Co., electrical engineers, Newcastle-on-Tyne, have obtained the contract for the complete electric light installation for the new flour-mill at Dunston being built by the Co-operative Wholesale Society. This mill, when completed, will be one of the largest in the kingdom, if not the largest, and the electric light plant, which is being put in in duplicate, will consist of two 400 "Tyne" compound wound dynamos, running at 600 revolutions per minute, and 466 16-C.P. incandescent lamps. The arc light installation will consist of one 9 unit "Tyne" compound wound dynamo, and 10 ampere "Tyne" arc lamps in strong watertight lanterns with reflectors. We hear that Messrs. Ernest Scott & Co. have a considerable quantity of work in hand of all descriptions, including a large contract for the lighting of Messrs. Arthurs & Co.'s works in Glasgow, in which two 400-light "Tyne" dynamos will be used. They are also lighting Messrs. John Bright & Bros. mills at Rochdale, the new works of the Bolton *Evening News*, and the cold meat rooms of the Northern Counties Ice Co.

UNIVERSITY OF GLASGOW.—We have received notice from the professors of naval architecture and marine engineering, and civil engineering and mechanics, in this University, that the scheme of classes in these departments has been revised, and that the times of meeting of the classes have been altered, at the suggestion of employers and intending students, so as to suit the convenience of men engaged in offices and works. In the first-mentioned department the course of instruction now extends over three sessions, and includes ship calculations, laying off of ships, stability of ships, resistance and propulsion of ships, their strength, design, and rolling, and the steam-engine. The junior class meets on Mondays, Wednesdays, and Fridays at 11 a.m., and the senior class on Mondays, Tuesdays, and Thursdays at the same hour, or at any other hour that may be more convenient; and in addition to this, a course of evening lectures, some twenty in number, will be given during the session on the Wednesday evenings of each week at 7.30, the subject being "The Stability of Ships." Classes in the second-mentioned department will meet for instruction in its various branches at 8 a.m. each weekday, with the exception of Class IV.—"Higher Applied Mechanics and Hydraulics"—which will meet daily, except Saturday, at 12 noon. The session extends, for both branches, from 5th November, 1890, till 24th April, 1891, and programmes of the classes, with regulations for degrees, and a list of bursaries open to students, will be forwarded on application to the Assistant Clerk, Matriculation Office, the University.

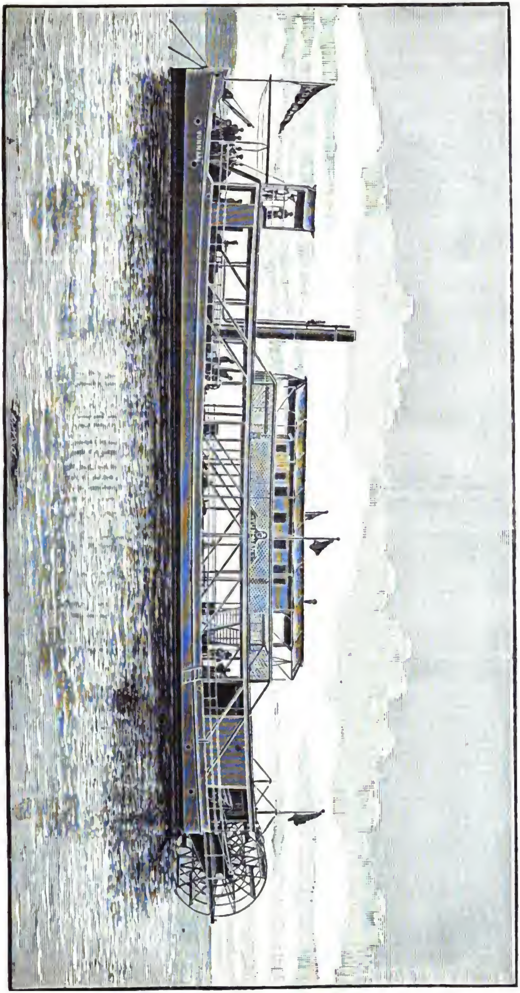
THE NEW STERN-WHEEL S.S. "YUNNAN."

THIS river stern-wheel steamer recently launched at Haiphong ran her trial trip to Phulangthuong in July last, with cargo and passengers on board.

The *Yunnan* is 136 ft. long over all, 24 ft. beam, and depth of hold, 6 ft., and has been entirely built at Haiphong from the designs of Mr. W. C. Jack, the *Ingénieur en chef* of the Service Subventionne Des Correspondances Fluviales au Tonkin. She has been specially constructed for the Navigation of the Songkoi, or Red River, and is a composite-built boat with shade deck, on which is placed the saloon and officers' accommodation. The boiler is placed forward under the pilot bridge, while the engines are placed aft, thus leaving a fine open space for deck passengers. These engines are a pair of high-pressure with cylinder 16½ in. diameter, by 48 in. stroke, and drive the boat easily at a speed of 10 knots. Joy's valve gear has been adopted, and the pumps are worked direct from the crop-heads, it having been found in the running of the *Laokay*, the last steamer built in Haiphong for the service, that the eccentrics wore away rapidly in the sandy water and they have been completely done away with in this case. Her steering qualities proved all that could be desired and, on a draft of 2 ft. 6 in., the double-balanced rudders were most easily handled by one steersman. The saloon, on the upper or shade deck, is most luxuriously fitted up, the panels being of black inlaid Tonkinese pearl work, and the upholstering in white hair cloth, all the seats being arranged in the American fashion, to fold and form beds as well. A large promenade space is left in front of and around the saloon, which will no doubt be most agreeable to passengers. The *Yunnan*, of which we here give an engraving, left about the beginning of August last, on her first voyage to Laokay, on the Chinese frontier, the Governor-General and most of the heads of the public service in Tonkin making the voyage with her.

Messrs. Marty & d'Abbadie are to be congratulated on this fine addition to their already numerous fleet of river steamers, more especially as the *Yunnan* will probably do more than any of her predecessors towards opening up the trade of the Chinese frontier by the routes of the Tonkin delta.

THE PADDLE-STEAMER "CRUISER."—The large and powerful double-engined paddle-steamer *Cruiser*, of the "Black Diamond-line," owned by Mr. Joseph Lawson, of South Shields, has again been put on her station after receiving new boilers and a thorough overhaul to engines and hull. The boilers were built by Mr. Matthew Straker, of South Shields, and are of the most modern type of double-return flue boilers; the furnaces are circular, and are each fitted with four Galloway tubes to induce perfect circulation and evaporation. Special attention has been given to the shells, the longitudinal seams having been carried well up clear of all bearers, &c. They are tested to 65lb. per square inch. The patent wheels, slides, pumps, and main shafts have all been thoroughly overhauled, new pistons have been fitted with Buckley's patent springs, and everything put in thorough good order. New wood and iron decks have also been fitted. On the trial trip everything worked satisfactory, and made the run from Newcastle Swing Bridge to Pilot's Jetty at South Shields (about nine miles) in a little over 30 minutes, and is expected to maintain a uniform speed of 14 knots. The whole of the work in connection with the above has been carried out by Anthony Proud, engineer, &c., Tyne Dock.



THE STERN-WHEEL STEAMER "YUNNAN."

Built by the "Service Subventionne des Correspondances Fluviales au Tonkin," Haiphong.

(For description see page 308.)

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Elloe.—On August 29th Messrs. W. Gray & Co., Limited, launched the fine steel screw steamer *Elloe*. She is of the following dimensions, viz.:—Length over all, 270 ft.; breadth, 36 ft. 6 in.; depth 19 ft. 5 in., and is built to the order of Mr. Christopher Furness, of West Hartlepool, for Messrs. Bennets & Co., of Grimsby. She will take Lloyd's highest class, and is of the well-decked type, with a long raised quarter-deck, having saloon and cabins aft, a long bridge of extra strength, topgallant forecastle with accommodation for crew. The hull is built on the web-frame principle, with double bottom under each hold for water-ballast. She will be schooner-rigged. The boats will be carried on beams overhead, and a complete equipment provided for general trading, including large donkey boiler, four steam winches, steam steering gear, &c. Fine triple-expansion engines, having cylinders 19 in., 30½ in., and 51 in. diam., with a 36 in. stroke of piston, giving 700 H.P. and two steel boilers to work at 150 lbs. pressure per square inch are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited.

Manin.—On August 30th Messrs. Raylton, Dixon & Co. launched a steel screw steamer of the following dimensions:—Length over all, 287 ft.; breadth, 39 ft.; depth moulded, 21 ft. 8 in.; deadweight capacity, about 3,300 tons, which vessel has been built to the order of Messrs. Arthur Holland & Co., London, being the eighth vessel launched by Messrs. Raylton, Dixon for this firm within six months. She is constructed on the web-frame principle, with poop, raised quarter-deck, and topgallant forecastle. Her engines will be fitted by the North-Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke; and she is fitted with direct acting steam windlass by Emerson, Walker & Co. On leaving the ways the vessel was christened *Manin*.

Herman Wedel Jarlsberg.—On August 30th Messrs. W. Gray & Co., Limited, launched a large steel screw steamer, which has been built to the order of Messrs. J. Christensen & Co., of Bergen, Norway. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 336 ft.; breadth, 41 ft. 6 in.; depth, 24 ft., and the deadweight capacity will not be less than 4,500 tons. The deck erections consist of a poop, long raised quarter-deck, long extended bridge of extra strength, and a topgallant forecastle. A handsome saloon and state rooms, together with the captain's room, will be fitted up in the poop, the engineers' and officers' accommodation in the after part of the bridge, and the crews' berths at the fore part of same. The hull is built with web frames, large hatchways are fitted, steam winches, steam steering gear amidships, and screw gear aft, patent direct steam windlass, two donkey boilers, double bottom under each hold for water-ballast, shifting boards throughout, two iron masts, square-rigged forward boats on beams overhead, and a complete outfit will be fitted for a first-class cargo boat. First-class engines, on the three-cylinder triple-expansion principle, working on three cranks, are being supplied by the Central Marine Works of Messrs. W. Gray & Co., Limited. They will develop over 1,200 H.P.; the cylinders are 24 in., 38 in., and 64 in. diam., and the piston stroke 42 in., and a constant supply of steam at a working pressure of 160 lbs. per square in. will be maintained by fine large steel boilers. The vessel has been superintended during construction by Captain Klaus Reimers on behalf of the owners. The ceremony of naming the vessel *Herman Wedel Jarlsberg* was gracefully performed by Miss Hall, of Blackheath, London. It may be added that this is the largest vessel ever constructed for Scandinavian owners.

Tigris.—On August 30th this vessel, built by Messrs. John Blumer & Co., of Sunderland, was successfully launched. She is of the spar deck type, 290 ft. long, 40 ft. beam, and 25 ft. 5in. depth. The spar deck is principally of iron, sheathed with teak right fore and aft. She will be fitted with triple-expansion engines, with cylinders 23½ in., 38 in., and 62 in. by 42 in. stroke, by the North-Eastern Marine Engineering Co., of Sunderland, and two large multi-tubular boilers 11 ft. 9 in. by 15 ft. 6 in., having a total heating surface of 3,800 square ft. and capable of working at 160 lbs. per square inch. She will have the latest improvements, including specially ventilated accommodation, deck-houses, steam stearing gear, direct acting steam windlass by Emerson, Walker & Co., and electric light throughout. The vessel is building to the order of the Persian Gulf S.S. Co., Limited, of London, and is from the specifications and under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. She is intended for the Persian Gulf trade, and is specially adapted for the transport of pilgrims, in which service a considerable portion of each year will be occupied. The ceremony of christening the boat was gracefully performed by Mrs. Robson, the wife of Colonel Robson, of the builders' firm, in the presence of Mr. Darly, one of the managing owners. A sister vessel, the *Euphrates*, is being built to the same order.

Oscarshal.—On August 30th there was launched from the yard of Messrs. Woods, Skinner & Co., Bill Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. Fearnley & Eger, of Christiania, Norway. The principal dimensions are:—Length, 237 ft.; beam, 33 ft.; depth, moulded, 18 ft.; with a deadweight carrying capacity of 1,800 tons. The vessel is constructed on the raised quarter-deck system, with cellular double-bottom all fore and aft, and will take the highest class at Lloyd's, and also Norwegian Veritas. The cabins are arranged in a large house on the bridge deck, and accommodation is provided for engineers and officers under after end of bridge, and for crew in topgallant forecastle. Steam and hand steering gear is fitted on flying bridge, and hand gear in wheelhouse aft direct steam windlass by Emerson, Walker & Co. The engines have also been built to Lloyd's and Norwegian Veritas requirements, by the North-Eastern Marine Engineering Co., Limited, Wallsend, and are on the triple-expansion principle, having cylinders 17 in., 28 in., and 46 in., with 33 in. stroke, capable of indicating 700 H.P., and propelling the ship at a speed of 9½ knots loaded. As the vessel left the ways she was named the *Oscarshal* by Mrs. Inga Anderson, of Grimstad. The berth vacated by *Oscarshal* will be immediately occupied by another vessel, also for Norwegian account.

Astrologer.—On August 30th Messrs. William Dobson & Co. launched at Low Walker a steel screw steamer, built to the order of Messrs. George Gibson & Co., of Leith. She will be fitted with triple-expansion engines by the North-Eastern Marine Engineering Co., Limited. The vessel was named *Astrologer*.

Empress of India.—On August 30th the first of three twin-screw steel steamers intended for the mail service between Vancouver and Japan and China was launched from the yard of the Naval Construction and Armaments Co. at Barrow, having been built to the order of the Canadian Pacific Railway Co. The christening ceremony was performed by Lady Louisa Egerton, who named the vessel *Empress of India*. Amongst those present were the Marquis of Hartington (chairman of the Naval Construction and Armaments Co.), Lord Edward Cavendish, M.P., and Mr. Bryce Douglas (managing director). The builders have constructed the vessel for a speed of 18 knots on the measured mile and 16½ knots on a 400 miles sea trip. In addition to being intended as a first-class passenger and mail steamer, she is specially constructed to carry troops and guns. The engines will indicate 10,000 H.P. The vessel is 485 ft. long over all, 51 ft. breadth, moulded, 36 ft. depth, moulded; tonnage, 5,700 tons gross. The arrangements and fittings for passengers are of the most complete character. Her officers will be specially selected from the merchant service, and they will all be members of the Royal Naval Reserve. The armament of the ship, which will be supplied by the Admiralty, will consist of the latest type of 4·7 in. guns, which will be taken out in the vessel and stored at Vancouver and Hong Kong, so that in cases of emergency the ship can be fully armed and made ready for cruiser purposes in the space of a few hours. At the after proceedings Lord Hartington proposed "Success to the *Empress of India*," and in doing so said the vessel would form a long and a strong link binding this country to its colonial possessions. He referred to the rapidity with which the vessel had been built, remarking that it was only nine months since her keel was laid, and a further period of two months would suffice to complete her.

Dunbeth.—On September 1st Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Stockton-on-Tees, a steel-screw steamer built to the order of Messrs. Macbeth & Gray, shipowners, Glasgow. Her dimensions are as follows:—289 ft. by 37 ft. 9 in. by 21 ft. 9 in., moulded. She is built on the cellular bottom principle, with long bridge, long raised quarter-deck, short well, and topgallant forecastle. She has steam windlass by Emerson, Walker & Thomson Bros., Limited, steam steering gear, and all modern improvements so as to admit of rapid loading and discharging. Her engines, on the triple-expansion surface-condensing principle, are by Messrs. Dunsmuir & Jackson, Govan, near Glasgow, and are of the following sizes:—22 in., 34 in., and 56 in. by 39 in. stroke, working pressure, 160 lbs. The engineers are also supplying four large steam winches, and suitable donkey boiler. As the vessel left the ways she was gracefully christened the *Dunbeth* by Mrs. Macbeth, of Dunbeth, Glasgow. The vessel and her machinery have been built under the superintendence of Mr. J. Donaldson, 75, Jamaica Street, Glasgow.

Steel Screw Steamer.—On September 1st there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer of the following dimensions:—Length, 300 ft.; breadth, 39 ft. 6 in.; depth, 22 ft. 2 in. moulded, and to class 100 A1 at Lloyd's on the well-decked rule. This vessel has water-ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including four double-cylindered steam winches, direct acting steam windlass, large donkey boiler, steam steering gear by Messrs. Muir & Caldwell, and Hastie's screw gear aft. The engines, which are to be supplied by Messrs. Wigham, Richardson & Co., are of the triple-expansion type, having cylinders 22½ in., 36½ in., and 60 in. by 39 in. stroke, and working at a pressure of 160 lbs.

Hesper.—On September 1st Messrs. Ropner & Son launched a steel screw steamer of the following dimensions:—Length, 301 ft.; breadth, 40 ft.; depth, moulded, 22 ft. 7 in. She has been built to class 100 A1 at Lloyd's, and will carry about 3,800 tons cargo and fuel. Her engines, by Messrs. T. Richardson & Sons, Hartlepool, are on the triple-expansion principle. The steamer has been built to the order of Messrs. G. Horsley & Son, of West Hartlepool, and was christened *Hesper*. She has patent windlass by Emerson, Walker & Co.

Ottoman.—On September 2nd Messrs. Laird Bros. floated from their No. 3 dock a large and powerful screw steamship, built for the British and North Atlantic Steam Navigation Co. —of which Messrs. Richards, Mills & Co. are the managers—and specially designed and constructed to embody all the latest improvements for the Atlantic cattle trade. As the vessel left the blocks she was named the *Ottoman*, Miss Richards performing the christening ceremony in the orthodox fashion. The *Ottoman* is the third steamer built for the company by Messrs. Laird, and is a larger and more powerful vessel than her predecessors, the *Norseman* and *Roman*, which are well known in the trade as most successful ships, delivering their cattle in fine condition and with exceptional immunity from loss. The new steamer has a length between perpendiculars of 403 ft., with 45 ft. 6 in. beam, and 36 ft. 6 in. depth to spar deck, and a gross tonnage of about 4,500 tons. She is constructed with a double bottom for water ballast on the longitudinal cellular system, having four decks, bridge-deck amidships, poop, and forecastle; and is built of Siemens' mild steel to the spar deck rule, for the 100 A class at Lloyd's, under special survey. There is also a shelter deck for cattle, extending from the midship house to forecastle and poop. She is fitted to carry upwards of 1,000 head of cattle. The system of ventilation and the arrangement of the cattle fittings generally have been very carefully designed and carried out on the most approved plan. The engines are of the direct acting inverted-cylinder, triple-compound type, with cylinders 31 in., 50 in., and 78 in. diameter, and 5 ft. stroke, and designed to indicate 3,000 H.P. on trial. The crank shaft, thrust shaft, piston rods, and other portions of the engines are of steel, and the propeller has a steel boss with manganese bronze blades. The boilers are of steel, three in number, cylindrical, double-ended, each having six Purves' ribbed furnaces, and are stayed for a working pressure of 150 lbs. per square inch. She is fitted with Emerson, Walker & Co.'s improved patent direct-acting windlass, also a powerful steam capstan on aft deck. Generally, the *Ottoman* has been designed and built with a view to insure her proving both in regard to construction, arrangement and outfit, one of the most perfect ships in the Atlantic cattle trade. The floating was witnessed by a considerable party, among whom were Mr. Richards, managing director, Mr. J. P. de Winton, of Carnarvon, consulting engineer, and other friends.

Hayter.—On September 4th the steamer *Hayter* was launched from the yard of the executors of Mr. T. A. Walker, at Sudbrook. She will be fitted with patent quadruple-expansion engines, and patent windlass by Emerson, Walker & Co.

Salatiga.—On September 8th Sir W. G. Armstrong, Mitchell & Co. launched from their Walker shipyard the steel screw *Salatiga*, built for the Deutsche Dampfschiffs-Rhederei, for its passenger and goods trade between Hamburg and Java. The chief dimensions are:—Length, 300 ft.; beam, 41 ft.; depth, moulded, 24 ft. 1 in. She will be capable of carrying about 3,000 tons deadweight on a moderate draught of water, and will be rigged as a two-masted schooner. The *Salatiga* will be fitted with machinery on the triple-expansion system by the Wallsend Slipway and Engineering Co.

Fulwell.—On September 11th there was launched from the shipbuilding yard of Messrs. J. L. Thompson & Sons, at North Sands, Sunderland, a steel screw steamer built to the order of Messrs. Tyzack & Branfoot, of Sunderland. The vessel is of the following dimensions, viz.:—Length, 300 ft.; breadth, 40 ft.; depth of hold, 19 ft. 6 in.; having a deadweight carrying capacity of 3,750 tons. The engines are of the triple-expansion type. The vessel was named *Fulwell*.

Citta di Venezia.—On September 13th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend, a very handsome steel screw steamer. Length over all, 390 ft. by 44 ft. 3 in. by 28 ft., moulded, depth, built for Messrs. Lavarello Bros., Genoa, for their passenger line between Genoa and South America. The vessel is built on the three-decked grade, classed 100 A1 at Lloyd's, and under special survey, and to the requirements of the Registro Italiano; has a long, full poop, long bridge-house amidships, and topgallant forecastle, water ballast in cellular double-bottom all fore and aft, four steam winches, and four powerful steam cranes for the rapid loading and discharging of cargo; horizontal auxiliary donkey boiler, steam steering gear, direct steam windlass, &c. The saloon, captain and officers' accommodation all under the bridge, the poop, 'tween decks, and lower 'tween decks being reserved and specially fitted up with iron bunks for carrying emigrants, about 2,000 in number. The engines will be fitted by the Wallsend Slipway and Engineering Co., Limited, triple-expansion, surface-condensing, 30 in., 50 in., and 79 in. by 54 in. stroke, capable of indicating 3,500 H.P., and of propelling the vessel 14 knots per hour. As the vessel left the stocks she was named the *Citta di Venezia* by Miss Mary Robinson, of Whitby, whilst the owners were represented by Captain Gottuzzo, of Genoa. Messrs. Lavarello Bros. have now a large and rapidly-extending trade between Italy and the River Plate, and carry yearly a larger number of emigrants between these ports than any other firm. Most of their steamers have been built on the Tyne, and are all exceedingly well fitted up, and command a preference over other lines sailing from Genoa. The above vessel is the largest of their fleet, and will be more completely fitted out than the earlier types, special attention having been paid to the comfort of the emigrants. We hope to have the opportunity of examining and further reporting upon this magnificent specimen of naval architecture before her departure from the Tyne.

Coatham.—On September 15th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length, over all, 270 ft.; breadth of beam, 36 ft. 6 in.; depth, 19 ft. 5 in. She has been built to the order of Messrs. English & Co., of Middlesbrough, and will take Lloyd's highest class. She has a poop containing saloon and cabins, long raised quarter-deck, long bridge, having the engineers' berths at the aft end, and topgallant forecastle with accommodation for the crew. The hull is built on the web-frame principle. Large hatchways are fitted, four steam winches, hand and steam steering gear amidships, and screw gear aft, patent windlass by Emerson, Walker & Co., donkey boiler, and double bottom under each hold for water ballast. Boats on beams overhead, and everything complete will be provided for general trading. Fine triple-expansion engines of 750 H.P., and two steel boilers to work at 150 lbs. pressure per square inch, are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. She was gracefully christened *Coatham* by Mrs. Rodam, wife of one of the managing owners. Captain Lowther has superintended the construction of the ship on behalf of the owners.

Drumalis.—On September 16th Messrs. William Pickersgill & Sons, of Southwick, launched what is said to be the largest steel sailing ship yet built on the North-East Coast. The vessel has four masts, and the dimensions are 310 ft. long, 42 ft. 4 in. broad, depth of hold, 24 ft. 7½ in.; and of 2,559 gross tonnage.

The vessel has been built to the order of Messrs. P. Iredale & Porter, of Liverpool, under Lloyd's special survey, and was christened the *Drumalis*.

Beechdene.—On September 16th Messrs Short Bros. launched from the yard at Pallion a steel screw steamer of the following dimensions:—Length between perpendiculars, 290 ft.; breadth extreme, 39 ft. 10 in.; and 22 ft. 3 in. depth, moulded; built to the order of Messrs. J. T. Lunn & Co., of Newcastle. Quadruple-expansion engines are to be fitted of about 1,000 I.H.P. by Messrs. W. Allan & Co., Scotia Engine Works, Sunderland. The vessel was named *Beechdene*.

Orfordness.—On Wednesday, September 17th, Messrs. Richardson, Duck & Co. launched from their building yard at South Stockton a steel screw steamer of the following dimensions, viz.:—Length, over all, 279 ft. 6 in.; breadth, extreme, 37 ft.; depth, moulded, 19 ft. 5 in.; tonnage, gross, about 1,920 tons. The vessel has been built to the order of Messrs. Farrar, Groves & Co., of London, and will be classed 100 A1 at Lloyd's. She has a raised quarter-deck, a long bridge from after engine-room bulkhead to stem and a double bottom on the cellular principle, extending fore and aft, for water ballast. She will be fitted with steam steering gear, steam windlass, four steam winches, stockless anchors, &c. Her engines, by Messrs. Blair & Co., Limited, Stockton, are triple-expansion, cylinders, 21 in., 34 in., and 56 in. by 36 in. stroke. As the vessel was leaving the ways she was christened *Orfordness* by Mrs. T. W. Pnmphrey, of Stockton-on-Tees.

Alacrity.—On Wednesday, September 17th, Messrs. Edward Withy & Co. launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. Wilson & Corner, of West Hartlepool. The vessel is over 280 ft. in length and built throughout of Siemens-Martin steel, with a large measurement and deadweight carrying capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge-house and a topgallant forecastle. All decks, deck erections, skylights, bulwarks, bulkheads, grain divisions, &c., are constructed of steel and iron. Cellular bottoms fitted all fore-and-aft for water ballast. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, patent windlass on forecastle deck, stockless anchors hauling up into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin is handsomely finished in polished hardwood with painted panels, executed in oils by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, with iron pole masts, and has been constructed under the personal supervision of Captain Corner. The vessel will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the vessel was gracefully christened *Alacrity* by Mrs. Wilson, wife of one of the partners.

Marston Moor.—On September 17th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a large screw steamer named the *Marston Moor*, which has been built for the South Shields Steam Shipping Co., of which Mr. Walter Runciman is the managing director. The following are the dimensions:—Length, 290 ft.; breadth, 40 ft.; depth, moulded, 22½ ft. The steamer will be supplied with triple-expansion engines and two large steel boilers, also built by Messrs. Readhead & Sons. The engines have cylinders of 23 in., 37½ in., and 61½ in. diameter, with a piston stroke of 39 in., and the boiler will work at a pressure of 160 lbs. to the square inch. The vessel is of the improved well-deck type, built under special survey to class 100 A1 at Lloyd's, and to comply with the Grain Cargoes Act, and she will have a deadweight carrying capacity of 3,700 tons. The ceremony of naming the vessel was performed by Miss Elliot, of Westoe.

Nyanza.—On September 17th Messrs Cochrane, Cooper & Schofield launched at Grove Hill, Beverley, a steam trawler which they have built for the contractors, Messrs. C. D. Holmes & Co., to the order of Mr. Hamlin. The vessel was named the *Nyanza*. Her dimensions are as follows:—Length, 100 ft.; beam 21 ft.; depth, 10 ft. 9 in. She is classed 100 A1 at Lloyd's. Her engines, of 50 H.P. triple-expansion, will be furnished by Messrs. C. D. Holmes & Co.

Achilles.—On September 20th there was launched by Earle's Shipbuilding and Engineering Co., Limited, at Hull, an iron screw trawling steamer named the *Achilles*, built to the order of Messrs. R. Blades & H. Rippon, of Hull, for North Sea fishing. The ship is 100 ft. long, 20 ft 6 in. beam, and 10 ft. 9 in. depth of hold, and has been constructed of iron to Lloyd's A1 class Her engines are triple-compound, with cylinders 12¾ in., 20 in., and 32 in. diameter, by 20-inch stroke, and her boiler is made for a working pressure of 150 lb. per square inch.

LAUNCHES.—Scotch.

Garnet.—On Thursday, August 28th, a steel screw steamer of 1,570 tons, named the *Garnet* was launched from the shipbuilding yard of Messrs. W. B. Thompson & Co., Limited, for the Dundee Gem Line Steam Shipping Co. The *Garnet* has triple-expansion engines, and is fully equipped for the Baltic and Mediterranean trade.

St. George.—On Saturday afternoon, August 30th, Messrs. Ramage & Ferguson, launched at Leith a very large composite auxiliary steam yacht named the *St. George*, built to the order of Mr. Ernest J. Wythes, of the Royal Yacht Squadron. Being intended for long foreign cruises, this yacht has been specially designed by Mr. W. C. Storey, of London, so as to combine the highest seaworthy qualities with great speed under both sail and steam. The inner skin and framework are of iron, much above Lloyd's requirements, sheathed outside entirely with teak, and heavily coppered to above the water-line. The extreme length of the yacht is nearly 200 ft., breadth outside of planking 32 ft., and depth moulded 18 ft. 9 in., while her tonnage is 830 Y.M. Triple-expansion engines, having cylinders 20 in., 30½ in., and 51 in. diameter, by 30 in. stroke, with two steel boilers working up to 160 lbs., are expected to drive the yacht at a high rate of speed under steam alone, the power being exerted through a two-bladed gun-metal patent Bevis propeller, one of the largest of this kind yet made. The spars, rigging, and sails, are of the most ample spread probably ever seen in a yacht, the rig being that of a three-masted barque with yards and studding sails on the foremast. A beautiful figure-head, representing St. George with sword in hand flanked by carved dragons on the trail boards, gives the bow of the yacht a characteristic appearance. In a vessel of this size the cabins are necessarily very spacious and lofty, while the fittings will be of the most luxurious and complete description. The owner's and friends' sleeping accommodation is aft, and connected by a passage with the dining saloon, and other apartments forward. A large deck saloon and chartroom are handsomely furnished on deck and built entirely of teak. Electric lighting is everywhere fitted, and a powerful search light is to be used for night work. A large company of yachtsmen and others interested in the building of this vessel witnessed the launch, and the naming ceremony was performed by Miss Rose, Kilravock Lodge, Edinburgh. The *St. George* is the hundredth vessel built by Messrs. Ramage & Ferguson, and the largest composite yacht ever constructed in Scotland.

Renown.—On August 30th Messrs. John Duthie, Sons & Co. shipbuilders, Aberdeen, launched a fine-modelled steam screw cargo vessel, built to the highest class at Lloyd's by order of Messrs. Duthie Brothers & Co., Aberdeen and London. The dimensions are—Length, 263 ft.; breadth, 35 ft.; depth, 19 ft.; and gross tonnage, 1,708 tons. The vessel was named *Renown*.

Emin Pasha.—On August 30th the Grangemouth Dockyard Company launched from their yard at Kellisbank, Alloa, a splendid steel barque of 1,500 tons register, to carry 2,550 tons deadweight on a draft of water of about 19 ft. The dimensions of the barque are—250 ft. by 38 ft., depth 21 ft., and has been classed 100 A1 at Lloyd's. The vessel left the ways beautifully at 3.15, and as she glided off she was named *Emin Pasha* by Miss Mitchell, daughter of Colonel Mitchell, of Tillicoultry House. The ship was built to the order of a Hamburg firm.

France.—On September 2nd Messrs. D. & W. Henderson & Co. launched from their shipbuilding yard at Meadowside, Partick, the *France*, a five-masted steel sailing ship, which is stated to be the largest sailing vessel in the world. Her gross tonnage is 3,750, while the carrying capacity is not less than 6,150 tons. She has been built to the order of Messrs. A. Dom. Bordies & Sons, of Paris—a firm owning between thirty and forty ships, all of them being engaged in the South American nitrate trade. The vessel will be square-rigged on the fore, main, mizzen, and jigger masts, while the fifth, which is styled the after-jigger, is to be rigged similar to the mizzen of a barque. The dimensions of the ship are:—Length, 360 ft.; breadth, 48 ft. 9 in.; and depth, 30 ft. The *France* has a double bottom, the space between the two being capable of holding 1,000 tons of water, and over them there is a water tank for 1,200 tons. In the hold of the vessel have been placed twelve tanks, 15 tons each, for holding nitrate. A couple of donkey engines have been placed on deck for working the windlasses, while other improved appliances and gear are to be provided.

Despina.—On September 5th the Campbeltown Shipbuilding Co. launched from their yard at Campbeltown (Firth of Clyde) a handsomely modelled steel screw steamer of 1,850 tons deadweight. Dimensions:—225 ft., between perpendiculars, by 32 ft. 7 in. by 17 ft. 4 in., moulded. Machinery:—Triple-expansion engines, 17 in., 27 in., and 44 in. by 33 in. stroke, by Messrs. Robert Harvey & Co., Parkgrove Iron Works, Glasgow. This steamer has long raised quarter-deck, bridge deck extending forward of foremast, topgallant forecastle, water-ballast amidships, complete and speedy pumping facilities, Emerson, Walker & Thompson Brothers' patent windlass, Alley & MacLellan's steam steering gear, workable from upper and lower bridges, and Hastie's screw-steering gear aft. All the latest improvements for navigating the ship economically and for the speedy loading and discharging of cargo are to be supplied, including three large steam winches, &c., &c. Steam will be supplied by a large boiler having three corrugated furnaces. It is expected an average speed of 9½ knots loaded at sea on a moderate consumption of fuel will be attained. The vessel has been built to class 100 A1 at Lloyd's, for Greek owners, and is intended for the Mediterranean and Black Sea Trade, for which she is specially adapted. Captain Margaroui, who has superintended the completion of the vessel, represented the owners, whose London agents are Messrs. Vagliano Bros. The steamer was gracefully named *Despina* by Miss MacNab, presently the guest of Stuart Hall, Esq., Seaside, Campbeltown.

Iverna.—On September 11th Messrs. Charles Connell & Co. launched at Scotstoun, the *Iverna*, a four-masted steel sailing ship of 2,300 tons gross, built for Messrs. A. Mackay & Co., Glasgow. Her dimensions are:—Length, 283 ft.; breadth, 42 ft. 6 in.; depth, 24 ft. 8 in.

Bullara.—On September 11th Messrs. Gourlay Bros. & Co., Dundee, launched a screw steamer named the *Bullara*, for the Adelaide Steam Shipping Co., Limited, Adelaide. The vessel is 260 ft. long, 37 ft. broad, and 18 ft. deep, and is intended for the company's Western Australian trade. She has a double cellular bottom. Accommodation is provided for 150 first and second-class passengers. The officers and engineers are berthed in a deck-house on the poop deck. The *Bullara*, which is 1,600 tons register, is to be provided with triple-expansion engines of 250 H.P.

Tapatinga.—On September 11th Messrs. Scott & Co. launched at Greenock a steel twin-screw steamer of 300 tons, named the *Tapatinga*, and of the following dimensions:—Length, 160 ft.; breadth, 24 ft.; and depth, 7 ft. 9 in. The *Tapatinga*, which will be supplied by the builders with triple-expansion engines, has been built to the order of the Amazon Steam Navigation Co.

Boston.—On September 13th Messrs. Alex. Stephen & Sons launched at Linthouse a steel screw steamer built for the Yarmouth Steamship Co., of Nova Scotia, in accordance with the instructions of the Hon. L. E. Baker, the president and manager of the company. The vessel is intended for passenger traffic between Boston and Yarmouth, and was gracefully named the *Boston* by Mrs. Baker. The *Boston* is a beautifully designed ship, fitted up in superb style for a very large number of first and second-class passengers, and with handsome accommodation for captain, officers, and crew. She has powerful triple-expansion engines suitable for developing a high speed, and is expected to prove the finest steamer that has ever been placed on the route referred to. She has been constructed under the personal supervision of Captain Doane, assisted in the machinery department by Mr. Geo. McFarlane and Mr. W. C. Rowe.

Prince Hendrick.—On September 13th Messrs. Caird & Co., Limited, launched from their shipbuilding yard at Greenock a magnificent steel screw steamer of 3,450 tons gross. Length, 357 ft.; breadth, 43 ft.; depth, moulded, 29 ft. 1 in. She is built to the highest class at Lloyd's, and will be supplied by the builders with triple-expansion engines of 2,600 I.H.P., and with all the latest improvements. The cylinders will be of 29 in., 48 in., and 77 in. diam. respectively, with 4½ ft. stroke. The two boilers will be double ended, and made entirely of steel, having 12 furnaces, and will be tested by hydraulic pressure to 340 pounds per square inch. The vessel is for the Stroomvart Maatchappij Nederland of Amsterdam, for passenger and cargo traffic between Holland and the Colonies. She is named *Prince Hendrick*.

Stella.—On September 15th at Clydebank, Messrs. J. & G. Thomson launched a new twin-screw steamer for the channel traffic of the London & South-Western Railway Co. The vessel was named the *Stella*. When nearing the water the steamer unexpectedly stopped, but she was at once propped up, and was floated with the next tide.

Yirawa.—On September 15th Messrs. William Denny & Brothers, Dumbarton, launched the s.s. *Virawa*, of about 3,500 tons gross register, for the British India Steam Navigation Co.'s cargo and passenger service. The ship will be fitted by Messrs. Denny & Co. with quadruple-expansion engines.

Polyphemus.—On September 15th Messrs. Scott & Co., Greenock, launched a steel screw steamer, named the *Polyphemus*, to the order of the Ocean Steamship Co., Liverpool. Dimensions.—Length, 336 ft.; breadth, 38 ft.; depth, 26 ft.; and of 2,900 tons gross. The builders will supply compound tandem engines of 1,500 I.H.P., the cylinder 26 ft. and 6½ in. respectively, with a piston stroke of 5 feet.

Iuyini.—On September 16th this vessel, built to the order of Messrs. J. T. Rennie, Son & Co., of London and Aberdeen, was launched from the yard of Messrs. Hall, Russell & Co., Aberdeen. Her dimensions are:—Length, 270 ft. 4 in.; breadth, 35 ft. 2 in.; and depth, 20 ft. 6 in. She is built on the spar-deck rule, and will be fitted with triple-expansion engines, also of Messrs. Hall, Russell's manufacture, with cylinders 21 in., 34 in. and 56 in. diameter, and 42 in. length of stroke. She will also be fitted throughout with electric light. This vessel is the fifth of the same design built for Messrs. Rennie, under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool.

Sterling.—On September 16th Messrs. S. & H. Morton & Co., Leith, launched a steel screw steamer, built to the order of the Ostlandake Lloyd's Co. Christiania, and intended for passenger traffic between Christiania and Newcastle. The dimensions are:—Length, 210 ft.; breadth, 30 ft.; depth, 21 ft. 3 in. to awning deck. The vessel, which was named the *Sterling*, will be fitted with triple-expansion engines.

Amra.—On September 16th there was launched from the yard of the Ailsa Shipbuilding Co., Troon, a steel screw steamer of the following dimensions:—190 ft. by 29 ft. by 20 ft., moulded to shade deck. The vessel is intended for the British India Steam Navigation Co., Limited, for their Indian coasting trade, and is fitted with steam steering gear, steam windlass, electric light throughout, and all the newest appliances. The engines are triple-expansion, having cylinders 16 in. and and 26 in., and 42 in. by 30 in. stroke, and are being constructed by Messrs. Dunsmuir & Jackson, Govan. This vessel is sister ship to the *Aska* and *Juba*, built last year for the same owners by the Ailsa Shipbuilding Co. On leaving the ways she was gracefully christened the *Amra* by Lady Aline, daughter of the Marquis of Ailsa, in whose honour the harbour and shipbuilding yard were gaily decorated.

Mermaid.—On September 19th Messrs. Wm. Simons & Co. launched from their works at Renfrew the patent twin-screw hopper-dredger *Mermaid*, of 1,000 tons hopper capacity, constructed to the order of the Aden Port Trust. The machinery has all been completed in the vessel previous to launching, and is of special design for the work required. Two sets of triple-expansion engines are provided of about 1,200 I.H.P. for driving the propeller and dredging machinery. The bucket ladder will dredge to a depth of 35 ft. under water level when the ladder is at an angle of 45 deg. The builders' patent raised bow and forecastle is provided for the additional strengthening of the vessel at bow, and also to enable the buckets to dredge in advance, to cut the vessel's own flotation, and to work close to the foot of quay walls. The dredger has been built under the superintendence of Mr. W. R. Kinipple, M.I.C.E. Westminster, Mr. Robert Anderson being the resident inspector.

Annie Walker.—A new steam trawler, named the *Annie Walker*, has been launched from the shipbuilding yard of Messrs. A. Hall & Sons, Aberdeen. The trawler is of the following dimensions:—Length, 96 ft.; breadth, 20 ft. 2 in.; and depth, 10 ft. 4 in. The vessel is to be fitted with compound surface-condensing engines of 50 N.H.P. She has been built to the order of Mr. Thomas Walker, fishcurer, New Pier Villa, Footdee.

LAUNCHES.—IRISH.

Mississippi.—On August 29th a steel schooner-rigged steamer, of about 3,574 tons, was launched at Belfast, owned by the Mississippi S.S. Co., London.

Shoalfisher.—On September 12th there was launched from the yard of Messrs. Paul Rodgers & Co., at Carrickfergus, a steel three-masted schooner, built under special survey, and classed 100 A1 at Lloyd's. The vessel has been built for Messrs. James Fisher & Sons, of Barrow-in-Furness, and is of the following dimensions:—Length, 106 ft.; breadth, 22 ft. 6 in.; depth of hold, 8 ft. 9 in.; registered tonnage, 99·11; and carrying capacity about 220 tons. She was named the *Shoalfisher*.

Sobraon.—On September 17th the screw steamer *Sobraon* was launched by Messrs. Harland & Wolff from their shipbuilding yard, Queen's Island, Belfast. The *Sobraon* will, when finished, take her place in the line of steamers belonging to Messrs. Thomas and John Brocklebank, of Liverpool, and will be employed in trade with the East Indies. Her dimensions are:—Length 345 ft.; breadth, 40 ft. 9 in.; gross tonnage, 3,200. After the launch the *Sobraon* was taken round to the Abercorn Basin, where she will be fitted with triple-expansion engines.

Ainsdale.—Mr. C. J. Biggar has launched from his yard in Londonderry a steel sailing ship of the following dimensions:—Length, 270 ft.; breadth, 39 ft.; depth, 23 ft.; gross tonnage, 1,825. The vessel has been built to the order of Messrs. J. Henry Iredale & Co., Liverpool. She was christened the *Ainsdale*.

LAUNCH.—SWEDEN.

A. Wicander.—On August 19th the new steamer *A. Wicander* was launched from the Lindholmen Shipyard, Sweden. The principal dimensions are:—Length, 213 ft.; breadth, 29½ ft.; depth in hold, 18½ ft.; and carrying capacity with a draught of 16 ft., 1,200 tons. The engines are triple-expansion, 750 indidated H.P., and there are two tubular boilers. The double bottom is divided into four watertight compartments, and will be connected by spacious tubes with a good-sized centrifugal pump in the engine-room. This is the first steamer which has been built in Sweden with the cellular double bottom for water ballast through the whole of the vessel. The *A. Wicander* is built very strongly throughout, and has been specially strengthened for ice breaking. It is intended to carry raw material and finished produce between the Wicander cork manufactories in Sweden and other countries.

LAUNCH.—RUSSIAN.

Dwianatzat Apostolov.—The new Russian battleship *Twelve Apostles (Dwianatzat Apostolov)*, which was launched last month with great ceremony at Nicholaieff, inherits a name which was very familiar to Englishmen during the Crimean War, and which was then borne by one of the 120 ton ships at Sebastopol. The new vessel, which is 320 ft. long and 60 ft. beam, has a displacement of 8,200 tons, and will be driven by engines which, with natural draught, are designed to develop 8,500 H.P., and to give the ironclad a speed of 15 knots. The ship has a partial belt of armour of a minimum thickness of 12 in., a steel protective deck, and barbettes plated with 16 in. armour. The armament is to consist of four 12 in. 52-ton breech-loading guns, four 9 in. 15½-ton brech-loading guns, and eight quick-firing guns, together with machine guns, and six torpedo tubes or launching carriages. Such, at least, was the original intention, although a proposal to substitute smaller weapons for the 52-ton guns seems to meet with official favour.

TRIAL TRIPS.

Lesbos.—On July 24th the new steel screw steamer *Lesbos*, built by the Flensburg Shipbuilding Co. for the Deutsche Levante Linie in Hamburg, made her trial trip in the Flensburg Bay. This steamer has the following dimensions:—272 ft. by 36 ft.. 2 in. by 20 ft. 10 in.; is built of steel, and is classed to First Div. Veritas. She is fitted specially for the Mediterranean trade, and has triple-expansion engines of 800 H.P. Speed, 11·25 knots.

Ella.—On August 20th the new steamer *Ella*, built at the Elsinore Iron Shipbuilding and Engineering Co. for account of the Osteraöen Steamer Co., had a very satisfactory trial trip. The *Ella* is built entirely of steel to Burea Veritas highest class, special survey. Dimensions—148 ft. length, in main deck, 24 ft. broad, and 11 ft. depth in hold. She has compound engines, with surface condenser, and a capacity of 250 I.H.P. The *Ella* is a sister ship to the *Asta*, *Yrsa*, and *Maja*, already delivered to the same company, and the results at the trial were the same as with these three steamers and very satisfactory.

Flamingo.—On August 20th the steel twin-screw steamer *Flamingo*, formerly *Lady Brassey*, went on her official trial. She was built on the Tyne in 1888 for passenger service in the south coast of England, and purchased in May last by the Amazon Steam Navigation Co., Limited, having undergone extensive alterations to suit her for trading on the Amazon River. Admiral Inglefield and the other directors of the comdany were on board. A spar deck has been put over the whole length and breadth of the raised quarter deck, and the bridge deck extended to the foremast, giving space for state rooms for 28 first-class passengers. The original saloon fittings below the main deck have been cleared away and the space made into holds for cargo. The condensing arrangements have been altered so as to suit the high temperature of the river water in Brazil. The vessel is 160 ft. between perpendiculars, 24 ft. beam moulded, and 8 ft. 3 in. depth in hold. The machinery consists of two sets of triple-expansion engines, having cylinders 10 in., 16 in., and 26 in., in diameter, with a stroke of 18 in., steam being supplied by a steel return boiler 12 ft. 4 in. in diameter and 10 ft. 6 in. long. Separate engines drive the air-circulating and feed pumps, and a duplex pumping engine supplies the sanitary tank. The alterations to hull and machinery have been carried out by Messrs. A. W. Robertson & Co., Victoria Docks, from designs and under the superintendence of Mr. James Pollock, Fenchurch Street, E.C.

Compania de Filipinas.—On August 21st a satisfactory trial trip of the screw-steamer *Compania de Filipinas* was made on the Clyde. This vessel has been built by Messrs. Lobnitz & Co., Renfrew, to the order of the "Compania General de Tobacos de Filipinas" of Barcelona, for service in Manila. Her dimensions are 180 ft. by 30 ft. by 12¾ ft., moulded. A mean speed of over 10 knots was attained running between Cloch and Cumbrae lights, being 12 per cent. above the guarantee. During the trial the vessel had on board 10 per cent. more cargo than specified, and the mean draft of water was three inches less than guaranteed. She is fitted with triple-expansion engines by the same builders with cylinders 15 in., 25 in., and 40 in. by 30 in. stroke. They indicated over 700 H.P. working smoothly. This steamer has been seven months under construction, and is the successor to several vessels built by Messrs. Lobnitz & Co. for the same owners

Rhodos.—On August 25th a sister ship to s.s. *Lesbos* made her trial trip in the Flensburg Bay. This vessel is also built by the Flensburg Shipbuilding Co. for the Deutsche Levante Linie, and is in all parts a similar ship as the s.s. *Lesbos*. The speed attained on the trial was 11¼ knots. The Levante Linie has a third sister ship building by the Flensburg Shipbuilding Co.

Haugesund.—On August 27th the s.s. *Haugesund*, recently built by W. Harkess & Son, of Middlesbro', for Carl Fogs & Co., of Haugesund, Norway, and engined by Gourlay Bros. & Co., of Dundee, had her trial trip in the Tees Bay. A large party were on board and after the vessel's compasses had been adjusted she was taken off Hartlepool and run on the measured mile, when a speed of 11¼ knots was obtained. The engines worked remarkably smoothly, and the trial was declared to be highly satisfactory in every respect. The steamer then returned to the Tees. She is intended for the American coasting trade.

Heligoland.—On August 27th the steel tank screw steamer *Heligoland*, built at the Walker shipyard of Sir. W. G. Armstrong & Co., was taken to sea for trial. The vessel has been specially constructed for the carriage of petroleum in bulk, and is capable of carrying about 3,500 tons on a moderate draught of water. For dealing with her cargo there are two powerful Worthington pumps connected with a very complete piping installation. The vessel is lighted throughout with electricity. The machinery has been supplied by the Wallsend Slipway and Engineering Co. After adjusting compasses, the vessel was put on the mile course off Hartley, when a mean speed of over 10¼ knots was attained. The *Heligoland* has been built for the Deutsch-Amerikanische Petroleum-Gesellschaft.

Prinses Sophie.—On August 27th the official trial trip of the *Prinses Sophie*, built and engined by Messrs. Caird & Co., Greenock, for the Stroomvart Maatschappij Nederland, of Amsterdam, took place on the Clyde. The *Prinses Sophie* is a steel screw steamer of 3,450 tons gross, with engines, on the triple-expansion principle, developing 2,600 I.H.P. The measured mile off Skelmorlie was covered twice, and the average rate of speed attained was 13¾ knots, or three-quarter knots in excess of the guaranteed rate.

Dunnottar Castle.—On August 28th the *Dunnottar Castle*, the largest and fastest vessel which the Castle Mail Packets Co. have yet had constructed for their South African service, had a successful trial cruise on the Clyde. Built by the Fairfield Co., the new steamer has a measurement of 5,500 tons, and has engines of between 6,000 and 7,000 H.P. She attained an average speed of 17 knots.

Weybridge.—On September 1st the s.s. *Weybridge*, a steel screw steamer, built by Sir Raylton Dixon & Co., of Middlesbro', proceeded from the Tees on her trial trip. This vessel, which has been built for Messrs. J. Temperley & Co., of Newcastle and London, for the Temperley Steam Shipping Co., Limited, is of the following dimensions:—Length, over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in.; deadweight carrying capacity, about 3,600 tons. She is built on the web-frame principle, with poop, raised quarter deck, and partial awning deck. Her engines have been fitted by Mr. John Dickinson, of Sunderland, of 190 N.H.P., with cylinders 22 in., 35 in., and 59 in. by 39 in. stroke. The trial proved, in every way satisfactory.

Cearense.—On September 2nd the trial took place of the *Cearense*, one of the Red Cross Line, owned by Messrs. Robert Singlehurst & Co., of Liverpool. The *Cearense* has been laid up for some time back having new boilers working at 200 lbs. pressure per square inch fitted to her, her engines being altered to the quadruple-expansion arrangement at the same time, so as to suit them for using with economy the high pressure of steam carried, and it is confidently expected that a great saving of coal will result. The work of converting the machinery, supplying and fitting the new boilers has been done by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool, to the specifications of Mr. George Hepburn, the company's engineer. Several important alterations to the vessel's accommodation, both in cargo and passenger arrangements have been made under the personal supervision of Mr. Wm. Isaacs, marine superintendent of the company, notably a deep water ballast tank just forward of the machinery space, and a new saloon in the 'tween decks aft. The engines worked well, and the performance was fully equal to what was expected. This is, we understand, the first time that engines have been quadrupled in Liverpool, as also the pressure higher than anything yet turned out in the port.

Balmore.—On September 3rd the new steamer *Balmore*, recently launched by Messrs. T & W. Smith, North Shields, to the order of the Albany Shipping Co., Limited, Dundee, of which Mr. James Scott is manager, proceeded to sea on her trial trip. The vessel is of the following dimensions, viz.:—Length, 229 ft.; breadth, 32 ft. 6 in.; depth, 16 ft. 1 in.; built of steel. The engines are triple-expansion, by the North-Eastern Marine Engineering Co., Limited, Wallsend: cylinders, 17 in., 28 in., and 46 in.; length of stroke, 33 in.; I.H.P., 550. After adjusting compasses, the vessel was put upon the measured mile, and recorded an average speed of 11 knots.

Para.—On September 4th the Royal Mail Steamer *Para*, 4,000 tons G.R., went out for a trial trip. This vessel has just been extensively altered and improved by the Royal Mail Co. by adding a promenade deck and bridge-house in which are placed luxurious music, ladies and smoking rooms, tastefully decorated to meet the present requirements of the travelling public. The dining saloon has also been changed from a long to a square one, extending from side to side of the ship, thus giving large additional ventilation, and is neatly finished with polished hard wood panelling and mirrors, giving a very pretty effect. The whole of the cabin arrangements have been rearranged, and are now large and commodious, with all modern improvements of spring bottom berths, folding lavatories, &c. There are numerous bath-rooms, with marble baths fitted for cold, hot, and shower baths. The ship is lighted throughout by electricity with a first-class installation by Messrs. Siemens & Co., so that nothing has been left undone which can in any way contribute to the comfort of the passengers she has to carry. While this work was proceeding Messrs. Day, Summers & Co., of Northam Iron Works, have fitted the vessel with new triple-expansion machinery, and the trial trip, which took place on Thursday, was to test the working of the new machinery and the speed of the vessel under the altered conditions. In both respects the trial was most satisfactory, the mean speed attained on four consecutive runs at the measured mile in Stokes Bay being 16¾ knots, the engines indicating 4,800 H.P. The contractors guaranteed a speed of 15¾ knots and 4,000 H.P. so that in both respects the results obtained largely exceeded the stipulations of the contract. The cylinders of the engines are 40 in., 63 in., and 96 in. diameter with a stroke of 4 ft. 6 in. There are 8 main boilers 13 ft. diameter and 10 ft. long, fitted with Fox's patent corrugated furnaces and constructed for a working pressure of 150 lbs.; the donkey boiler is 9 ft. 3 in. diameter and 8 ft. 8 in. long.

Radnorshire.—On September 4th the s.s. *Radnorshire*, a new vessel of 4,300 tons deadweight, built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs. D. J. Jenkins & Co., of London, and intended for the China and Japan trade, left the Tyne for sea, and after a satisfactory trial trip, proceeded to Antwerp to load for the East. The engines are triple-expansion by the Wallsend Slipway and Engineering Co., Limited. Cylinders 23 in., 38 in., and 61 in. by 39 in. stroke, and the vessel has been completed under the superintendence of Mr. C. E. Hudson.

Isabel.—On September 4th the new steel screw tug *Isabel*, built and engined by Messrs. Vosper, of Portsmouth, with boiler by Messrs. Lindsey, Burnet & Co., of Govan, from the designs and to the order of Mr. James Watkins, of 121, Fenchurch Street, London, ran her trial in Stokes Bay. The company on board included representatives of the Admiralty, Board of Trade, Royal Mail Co., and others. The results were highly satisfactory. Engines, triple three-crank; cylinders, 12½ in., 19 in., and 32 in., by 21 in. stroke. They indicated 380 H.P. The dimensions of the boat are:—86 ft. 8 in. by 17 ft. 8 in. by 10 ft. 3 in.

Sola.—On September 10th the s.s. *Sola*, a steel screw steamer, built by Messrs. Sir Raylton Dixon & Co. for Messrs. Arthur Holland & Co., London, took her trial trip from the Tees. This boat is built on the web-frame principle, having a poop, raised quarter-deck, long bridge, and topgallant forecastle and is of the following dimensions:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; deadweight capacity, about 3,300 tons. Her engines, which have been fitted by Messrs. the North-Eastern Engineering Co., Limited, of Sunderland, with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, gave entire satisfaction on the trial run. The *Sola* is the seventh vessel that Messrs. Dixon have built to the order of Messrs. Holland this year, and they have also three more in course of construction.

Lanark.—On September 10th the fine steel screw steamer *Lanark*, which was recently launched by Messrs. Russell & Co. from their Greenock yard, was taken on her trial trip on the Clyde. The vessel has been built to the order of G. M. Steeves, Esq., of Liverpool, and is of the following dimensions:—Length, 320 ft.; beam, 42 ft. 6 in.; depth, 28 ft. 6 in. She has been built to the highest class at Lloyd's, under the three-deck rule, and is capable of carrying nearly 5,000 tons deadweight. The machinery has been supplied by Messrs. Dunsmuir & Jackson, of Glasgow, according to the specifications of Messrs. Flannery & Blackiston, of Liverpool and London, who also superintended it during construction. The cylinders are 24 in., 39 in., and 64 in. diameter, with a stroke of 45 in. Unusually large double-ended boilers are fitted, suitable for a working pressure of 150 lbs. Two runs were made on the measured mile, when the engines worked extremely well at 78 revolutions, the vessel being light, and giving a mean speed of close on 11 knots. The engines worked so well throughout, that on the completion of the trial, the vessel proceeded at once to Cardiff to load for the East.

Hero.—On September 12th the s.s. *Hero*, a steel screw steamer, built for the Bristol Steam Navigation Co., Limited, of Bristol, by Messrs. Sir Raylton Dixon & Co., Middlesbro', took her trial trip from the Tees. This vessel is built with raised quarter-deck with accommodation under bridge for captain, officers, and engineers. Her chief dimensions are:—Length, over all, 208 ft. 9 in.; breadth, 30 ft.; depth, moulded, 14 ft. 3 in.; deadweight capacity, about 950 tons. She is very completely fitted with four steam cranes and steam winches and her mast and funnel made to lower down for passing bridges. Her machinery, which has been fitted by Messrs. Blair & Co., Limited, of Stockton, having cylinders 16½ in., 27 in., and 44 in. by 30 in. stroke, worked to entire satisfaction on trial.

Imogen.—On September 12th the steam yacht *Imogen*, recently launched by Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, went down the river for speed trial, and on the measured mile attained a speed of fully 14 knots per hour, the engines working without hitch or stoppage of any kind. The *Imogen* is a finely modelled steam screw yacht of 410 tons yacht measurement, her dimensions being 157 ft. by 24 ft. by 15 ft. 6 in. She has been built to the order of Mr. J. R. Wood, of New South Wales, and is schooner-rigged. Deck-houses and all deck fittings are of teak, with bulwarks of steel, panelled with teak. Dining saloon is on deck forward, panelled in fumigated oak. A handsome staircase leads from saloon to drawing-room below, which is tastefully fitted up in walnut and mahogany, picked out in bronze and gold. Aft of this is owner's room, which is fitted up in maple and walnut. Adjoining owner's room are nursery, bath-room, &c. Forward of drawing-room are three state rooms fitted in handsome style, also dark room for photographic purposes, steward's, servants', and cook's rooms, bath, &c. The smoking-room is on deck-house aft, and is fitted up in dark mahogany, and from this deck-house stair leads to other suite of state rooms, bath rooms, &c. The quarters for officers and crew, which are roomy and comfortable, are all situated aft. The vessel is fitted with electric bells and electric light throughout. The space under cabin floors is divided off into wine cellars, baggage-room, store-room, &c. The engines are the builders' patent quadruple-expansion type, to indicate 1,000 H.P., and it is claimed for these engines that they are specially adapted for yachts, owing to the absence of vibration in working, and to the small space they occupy, which in the *Imogen* has enabled the builders to provide so much accommodation in a yacht of her dimensions. A considerable amount of interest was taken in the trial owing to her being the first large yacht fitted with this type of engines. Besides the owner and party, there were present, amongst others, at trial, Mr. G. L. Watson, designer of the *Thistle*, Mr. James A. Allan, and Mr. Richard G. Allan, of the "Allan" Line, with their superintending engineer, Mr. D. Johnston. Mr. C. J. North, representing the Admiralty, and Mr. John Darling, Union Steamship Co., of New Zealand, &c.

Lydia.—On September 12th the inaugural sail of the s.s. *Lydia*, built by Messrs. J. & G. Thomson, Clydebank, for the London & South-Western Railway Co., took place on the Firth of Clyde. The cards of invitation bore that the company were to assist at the "trial trip" of the *Lydia*, a function which has for its central feature running the measured mile. But this entirely practical experiment had been carried through on the 11th, when the speed of 19½ knots was attained under ordinary conditions, and accordingly the run on the 12th resolved itself into one of pure pleasure. Amongst the gentlemen present were:—Mr. William Houldsworth, Captain Dixon, R.N., Mr. David Caw, Mr. W. Main, Admiralty Overseer; Mr. Sanderson, Lloyd's; Mr. J. J. Stuart, R.N.; Mr. J. R. D. Johnstone, R.N.; Mr. G. Herriot, Board of Trade; Mr. D. Hope MacBrayne, Capt. Fowler, Mr. Thomas W. Traill, Board of Trade; Mr, James R. Thomson, Mr. George P. Thomson, Mr. W. H. Malpas, Admiralty Overseer; Messrs. Samnays, Lnsh, Bndden, and Recks, representing the London & South-Western Railway Co.; Mr. J. Grant, Mr. J. G. Dunlop, Mr. Mott, Board of Trade Surveyor; Mr. C. J. North, R.N., Admiralty Engineer Overseer in the Clyde District. The weather, which was somewhat unpromising in the morning, brightened about mid-day, and the afternoon was exceedingly pleasant, the Firth looking its best under brilliant sunshine. The general company joined the steamer at Gourock, from which the *Lydia* steamed down to near Ailsa Craig. As the Craig was neared the steamer was put about, and on the return journey an excellent dinner was partaken of in the cabin. The early afternoon meal was appreciated all the more, perhaps, that no toast list followed, the company going on deck again and enjoying the sunshine and fresh air. The *Lydia* is one of three twin-screws, built by Messrs. J. & G. Thomson, and commissioned by the London & South-Western Railway Co. The first of the trio was the *Frederica*, now occupying the station between Southampton and the Channel Islands, for which all three are intended. The *Lydia* is the second of the number, and the *Stella* is expected to be launched shortly. With the launch of the *Stella* the builders will have completed their contracts in periods of seven, eight, and nine months respectively. The three steamers are all of the same dimensions, viz.:—Gross tonnage, 1,050; length, 265 ft.; breadth, 36 ft.; 6,000 H P. The *Lydia* is built of steel throughout, and is the highest class for Lloyd's and Board of Trade certificates. Rigged with two masts, and beautiful in line, she has a very handsome appearance, while at the same time she has been specially built to stand the heavy seas of the English Channel, and is fitted with the latest appliances for working cargo. Sleeping accommodation is provided for 170 first-class and 70 second-class passengers, with ample space in addition for those who travel by steerage. The dining saloon is handsomely fitted up in mahogany, relieved with satin-wood panels admirably decorative in effect. The upholstery work, which is admirable throughout, has been carried out by Messrs. J. G. Rowan & Co., of Glasgow and Greenock. Private deck cabins are provided for ladies and gentlemen, with similar accommodation for second-class passengers before the saloon. The ship is lighted throughout with electricity, the installation being carried out by the builders. The *Lydia* is fitted up so as to carry 50 soldiers without notice. Her stokeholds are capable of being put under forced draught, and she is fitted up with Harrison's steam steering gear, and with Clark, Chapman & Co.'s windlasses and warping capstans. In short, the *Lydia*, intended for the angry waters lying between Southampton and the Channel Islands, seems to combine elegance and stability in no ordinary degree, and is therefore fitted in all respects to fulfil her mission.

Rubio.—On September 15th the s.s. *Rubio* was taken out for trial with very satisfactory results, a speed of 11½ knots being obtained. Her dimensions are:—250 ft. by 34 ft. by 18 ft. 3 in., moulded, built by Messrs. Irvine & Co., West Hartlepool, for Messrs. Orders & Handford, Newport (Mon.) Engines, 19 in., 30 in., and 50 in. by 36 in.; 160 lbs. pressure, by Messrs. Westgarth, English & Co., Middlesbro'.

Sarah Jolliffe.—On September 16th the new steel screw steamer *Sarah Jolliffe*, built by Messrs. John Readhead & Sons, West Docks, South Shields, for Messrs. W. & T. Jolliffe, of Liverpool, was taken to sea on her trial trip. The dimensions of the *Sarah Jolliffe* are:—136 ft by 25½ ft. by 14 ft., moulded, depth, and she is fitted with triple-expansion engines, having a N.H.P. of 250. The engines are supplied with steam from a large steel boiler with Purvis's patent furnaces, working at a pressure of 160 lbs. The engines and boilers were also made by Messrs. Readhead. The vessel had a very successful trial, the speed attained being 13 knots on the measured mile. The *Sarah Jolliffe* is specially adapted for long over-sea towages, and the passenger trade from the Mersey, and has been built under the inspection of Mr. Thos. Grant, the superintendent for Messrs. Jolliffe.

Arranmore.—On September 16th the screw steamer *Arranmore*, built for the Clyde Steam Shipping Co. by Messrs. W. B. Thompson & Co., went down the Tay on her trial trip. A satisfactory rate of speed was attained, and the vessel behaved admirably. The *Arranmore* left in ballast for the Clyde in the afternoon.

Rockabill.—On September 19th the *Rockabill*, a steel screw steamer built by Messrs. Sir Raylton Dixon & Co., Middlesbro', to the order of Messrs. Farrar, Groves & Co., of London, proceeded from the Tees on her trial trip. This vessel is built with steel raised quarter-deck, having a continuous bridge deck forming partial awning deck with poop aft. Her chief dimensions are:—Length, over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in., with a carrying capacity of about 3,600 tons. Her engines have been fitted by Messrs. George Clarke, Limited, Sunderland, of 200 N.H.P., having cylinders

22 in., 36½ in., and 60 in. by 42 in. stroke, and these proved perfectly satisfactory on trial. The owners were represented by Mr. Farrar, of Eccles, the senior member of the firm and several of the shareholders. This is the second vessel Messrs. Dixon have built for these owners.

Iron King.—On September 20th the screw steamer *Iron King*, recently launched by the Ailsa Shipbuilding Co., Troon, for Henry Howie, Esq., of Whitehaven, went her trial trip, and ran the measured mile at Skelmorlie, when she attained the successful result of 11¾ knots mean speed per hour. The vessel is 210 ft. by 11 ft. 9 in., and her engines, which have been supplied by Messrs. Muir & Houston, of Glasgow, are triple-expansion, 14 in., 23 in., and 36 in. by 27 in. stroke.

Penwith.—On September 20th the new steel steamer *Penwith*, built and engined by Messrs. Harvey & Co., Limited, of Hayle, Cornwall, to the order of Messrs. R. & B. Chellew, Truro, left the port of Hayle for her trial trip. The steamer was in charge of Mr. H. N. Harvey, the manager of the works, assisted by Mr. Bickle, chief draughtsman, and Mr. Winter, chief foreman of the shipyard. Messrs. R. Chellew and William Hodge represented the owners. The *Penwith* steamed steadily out of the harbour, navigating the narrow channel with great ease, thus showing the steering capabilities to be all that could be desired. After the necessary manœuvring to adjust the compasses, the engines underwent a variety of trials at full speed, and afterwards made a run of an hour's duration with the engines limited to 80 revolutions. The distance by log and chart showed over 11 knots for the hour, which was considered very satisfactory. The vessel then proceeded to Cardiff to load coal for the Mediterranean squadron at Malta, under the charge of Captain Williams—Mr. James Williams, the company's superintendent engineer, taking charge of the engine department. The vessel arrived at Cardiff on the following day, the engines having worked during the voyage most satisfactorily. The *Penwith* is of the following dimensions:—Length, 270 ft.; breadth, 36½ ft.; depth, moulded, 20 ft. Her registered tonnage is 1,260 tons, and her deadweight carrying capacity 2,900 tons. She is built to Lloyd's highest class on the modern well-deck type, and is of steel throughout. Her engines are capable of developing 1,000 H.P., the cylinders being 21½ in., 33 in., and 56 in., with 39 in. stroke. Her boilers—two in number—are 13 ft. 6 in. diameter and 10 ft. long, and her working pressure is 160 lbs. per square inch.

Reviews.

Transactions of the Institution of Naval Architects. Edited by George Holmes, Secretary. London: Henry Sotheran & Co. 1890.

A copy of these Transactions for the present year has been sent us, which possesses the merit of being well got up and generally supervised throughout. If one may judge by the outward appearance of the volume, the type, the avoidance of any appreciable errors in the verbal matter, or the plans illustrating the papers, the Institution is certainly in the zenith of its power. It is, however, rather to the character of the papers themselves that we must turn if we want to see what good is being done by this the leading centre for the dissemination of shipbuilding knowledge. Unfortunately this year, quality is rather below the mark for some unexplained reason. Perhaps it is that a steady career of prosperity having set in, developments are now fewer than they were in the past in this direction, or that they get known in some other way. Certainly little was brought forward on this occasion with which members were not already generally familiar, or which was of any but limited interest. Amongst the exceptions to this rule were perhaps the "Notes on Recent Naval Manœuvres," by Mr. W. H. White. A very important point about this paper was the fact that the chief constructor went to sea in one of the ironclads himself. This was therefore a recital of his experiences, and that they proved very interesting to the audience may be judged by the discussion elicited. As the present Admiralty have been quite right in permitting opinions to be taken on the subject of their current designs, so we may hope they have sanctioned the going to sea of their naval architects in this year's manœuvres. This is what is wanted on every occasion to give experience to constructors. The outcome of the reading of this paper, which may be taken to have been an invitation to criticism, was on the whole favourable to the class of ships now being built. The *Admirals* and the *Medeas* came in for a good deal of discussion, the most talk was perhaps, however, about forced draught, on which opinions were still divided.

An important paper by Prof. Jenkins was on the "Strength of ships with reference to the distribution of shearing stress over a transverse section." It is therein shown that the greatest shearing stress is in the line of the neutral axis. Values are given, and these appeared more than was generally supposed looking to what was evoked at the discussion. Whether such papers as these have any effect on the rules regulating the scantlings with the register societies who control these matters remains to be seen; but the value of such an investigation is incalculable and entitled to great praise. Mr. A. B. Brown, of Edinburgh, introduced his new system of combined steam and hydraulic machinery for the loading, discharging, and steering of steamships, complete diagrams being furnished. However we may attach importance to a subject of this kind, it is not altogether suitable for reading at a public meeting, for the reason that the general body of members cannot comprehend readily the intricate details involved. As a proof of this, the discussion was very limited, and finished with four speakers. Mr. Read, of Lloyd's Register Society, read a paper "On the variation of the stress on vessels at sea due to wave motion." This is necessarily a difficult subject, the data upon which to go being unsatisfactory. Probably the most that could be made of it was made by the writer. High mathematics were required in the elucidation of the theories. The only question in work of this kind is whether it is at all likely to take the place of the model experiments which typify beforehand with such wonderful exactness what the actual ship will do. We think not. However, in some way probably, the results obtained will be of assistance to designers. They are on the records of the Institution, and therefore in the best place for the purpose,

Professor Lewes, of the Royal Naval College, is responsible for a paper on the "Spontaneous Ignition of Coal Cargoes." This interesting subject is divided into the influence of carbon to produce heating, the action of the bituminous constituents of the coal in spontaneous ignition, and then that of the foreign substances. The professor puts forward the following theory: That when the newly-won coal is brought to the mouth of the pit, it absorbs air on its surface immediately, and as it is the air which produces the firing we should endeavour to keep the coal as large as possible. This is impossible, however. When cargoes are therefore stowed away there is a lot of slack intimately mixed with air, and the larger the cargoes, the more the reduction into slack that goes on, and the less chance of the outer atmosphere circulating to the middle of the cargo. The dangers of ignition are, of course, intensified by long voyages too, and the greater time allowed for the action to continue, with the possible increased heat of the tropics in addition. To ventilate the cargo is a mistake, as by ordinary methods just about the right amount of air is introduced to create the greatest heating. Another point mentioned is the higher temperatures of triple-expansion engines and their effects on coal cargoes, as compared with the old compounds. The precautions advised are the making of coal compartments gas-tight, with the exception of a 2-in. pipe, led up the nearest mast to carry off any vapours evolved, and the letting in of cylinders of carbonic acid gas amongst the cargo, so that when heating takes place, a fusible plug melts and the spreading of the gas lowers the temperature immediately. Water is said to be of no use after a fire has once taken place, but the best way of applying it would be through pipes laid along the bottom, and which should be opened when alarm thermometers, also advocated, give warning of danger. Elaborate experiments were made at the meeting to prove the theories advanced, and the standing the professor has is a sufficient guarantee he is not far out in his reasonings. Whether practical men will agree with him in his remedies is another matter. The subject concerns marine engineers very considerably as regards the stowage of coals for use on long voyages. We have therefore been induced to notice it at some length.

There is nothing else calling for mention in the Transactions. We find at the end memoirs of distinguished members who have passed away during the year, and a good index of the names of the various speakers.

The Journal of the Iron and Steel Institute. No. 1.: 1890. London: E. & F. N. Spon.

This Institute is representative of the iron and steel industries in England and seems very properly to take in knowledge wherever it may be acquired, so that though nominally with its centre in London, and dealing with our own country only, yet we find from the journal before us that in reality we have the whole world exposed to view in this branch of manufacture. It may be asked how is this task accomplished? Our reply is that instead of relying solely upon papers brought forward by members, very important mainstay though this is, we find a complete collection of notes of every conceivable kind bearing on the subject. The advantage of such a system is obvious. A member can depend on finding in the journal everything he can possibly want. It is up to the times thoroughly, and therefore of value accordingly. The practice of the Institute seems to be to publish two journals in a year, this being the first and relating to the London meeting in May, 160 pages are devoted to papers and the discussions upon them, while the remaining 240 odd are absorbed by the appendix and notes "On the progress of the Home and Foreign iron and steel industries." It may be stated at once that the average of the papers read is of a very high order, and the Institute is in a very flourishing condition. Some of the communications are abstracts only, where presumably it is to the advantage of readers that this should be so. This is a plan that other institutions might follow where quantity too often predominates over quality. Again, a good system obtains here of written contributions to the discussion as well as of original papers.

These industries are so closely allied to shipbuilding, that no apology is necessary for dipping a little closely into what these pages have to tell us. First there is a "New form of Siemens' furnace" for puddling, which was well received; next a most elaborate paper by Mons. F. Osmond, of Paris, "On the critical points of Iron and Steel." This would appear likely to be of great service to manufacturers, judging from the discussion that followed. There is an important communication also from Mr. W. J. Keep, Detroit, U.S.A., "On Aluminium in carbonised iron." This paper shows that the greatest care has been taken in its preparation, and engineers with no particular knowledge of the properties of iron would learn much from it. In the result it would seem that with the expense attending the introduction of the costly aluminium, it is doubtful if there is a corresponding gain. The greater fluidity given is useful in difficult or thin castings, but for large work the crystalline character of the steel formed is a bad feature. There were ten papers or abstracts in all, many being from foreign contributors.

Turning to the notes we find iron ores first treated. Here we start with the ores of Antrim and go on to Sweden, Canada, the United States and everywhere about which there is anything to say. The mining of the metal is then in like manner told, afterwards the various refractory materials. Under fuel, coal of course receives first attention. Here there is a description of the different fields. After noticing the English ones and the recent finds near Dover, the rest of those known is discussed on the most recent information. Liquid fuel, natural and artificial gases, are found in this connection also. In coal mining we read there is a saving of about 1s. 2d. a ton on an average where machines are used instead of hand labour. Ventilation, safely lamps and electric mining signals are noted amongst other items. The production and chemical composition of pig iron, with blast furnace slags, are mentioned fully, as also foundry practice. Malleable iron and forge and mill machinery are all allotted a place, and the production of steel by the open hearth and Bessemer processes is assigned several pages, till we come to the "further treatment of iron and steel." This last includes such branches as electric welding and the new method of making seamless tubes by the Mannesmann process. The physical and chemical properties complete this section of the journal, statistics and the index only following. It may be remarked that foot-notes are at the bottom of every page, giving the authority for the extracts. It is possible, therefore, to test the value of the notes if any doubt be cast on them. The volume is neatly bound, of a handy size, and reflects great credit on those responsible for its production.

MESSRS FLEMING & FERGUSON, shipbuilders and engineers, Paisley, have received an order from Messrs. Allan, of the Allan Line, for a large steel steam yacht, to be fitted with a set of the builders' patent quadruple-expansion engines, to work with a pressure of 200 lbs., and indicate 1,000 H.P. The yacht [illegible] built to the design and under the superintendence of [illegible] Watson, the well-known yacht designer.

Miscellaneous.

ASBESTOS FIREPROOF CURTAINS.—The United Asbestos Co. have received the following letter from the lessee of the Queen's Theatre, Manchester:—"You are aware no doubt that my theatre has just been destroyed by fire, which gave one a practical test of your Asbestos 'Victor' Metallic Fireproof Curtain, put in some time ago. Although for a long time the extent of the fire on one side of the curtain was so great that it must have been red hot, it remained intact, and the stage was saved, and the stage stock uninjured. Had it not been for the curtain this part of the theatre would have been as big a wreck as the other." This, we understand, was the first occasion on which a "Victor" Metallic drop curtain has been severely and practically tested, and justifies the claim of the company as to its fireproof character. This "Victor" metallic drop curtain is now fitted to quite a number of theatres and music halls, and appears to answer its purpose most effectually. The same company manufacture *Asbestos blankets*, which are intended for isolating fires in ships, and if all sea-going steamers would carry a supply of them many a small fire might be checked, and the total destruction of the ship averted.

A DEAD HEAT ACROSS THE ATLANTIC.—The arrival of the White Star liner *Teutonic* and of the Inman steamship *City of New York*, which left New York on Wednesday morning, September 17th, the former 20 minutes after her rival, was anxiously looked for at Queenstown, it being fully expected that rapid passages would be made. At 1.9 p.m., September 23rd, the *City of New York* arrived off Roches Point, having accomplished the voyage in 5 days 23 hours 14 minutes. This is her best Eastern passage. The *Teutonic*, which travelled by a route 21 miles longer, arrived 20 minutes later. There was brisk betting on the result between the passengers on board. The weather on the Atlantic was very fine, and the only thing that impeded their progress was the fog which prevailed on Saturday and necessitated the slowing down of the *City of New York's* engines for three hours. The *Teutonic* kept the other vessel in view until Friday. Fog was experienced the next day, but on Sunday those on board the *City of New York* saw the White Star liner again, following them about the same distance behind as when they started from Sandy Hook. From this time they never lost sight of each other. The following are abstracts from their respective logs:—*City of New York.*—18th, 486 miles; 19th, 438 miles; 20th, 434 miles; 21st, 450 miles; 22nd, 474 miles; 23rd, 491 miles—total, 2,773 miles. *Teutonic.*—18th 490 miles; 19th, 450 miles; 20th, 460 miles; 21st, 444 miles, 22nd, 454 miles; 23rd, 496 miles—total, 2,794 miles.

THE SHIPBUILDING TRADE.—Mr. R. Knight, general secretary of the Boilermakers' and Iron Shipbuilders' Society, in his monthly report for August, after referring to the fact that returns have not been received from Ipswich, Grangemouth, Motherwell, Limerick, and Falmonth, says:—"We find we have 1,798 members out of employment, compared with 1,444 last month, and 1,714 in the corresponding month of 1888. Taking into account the increase of members during the past two years, the percentage of members now out of employment is only 5, compared with 6·2 in September, 1888. The outlook in the shipbuilding trade has been considerably improved by the announcement of a number of orders having been placed on the Clyde and Wear. The Clan Line have contracted for six new steamers, three of which are to be built by Messrs. Alex. Stephens & Son, on the Clyde, and three by Messrs. Doxford, on the Wear. The three vessels which have come to the Wear will be very acceptable, and if a few more orders were to come to the Tyne the winter might be regarded with equanimity. Not less than 86,000 tons of new contracts have been placed with the Clyde shipbuilders during August, as compared with 12,000 tons last month, and 21,000 tons in August, 1889. We also learn that during the past month orders have been booked for 20 new vessels on the north-east coast from Blyth to Whitby. The majority of the vessels average 3,500 tons gross register. The orders have been placed principally in the Hartlepools and on the Tees, two have been booked at Whitby, and a few at Sunderland and on the Tyne. A company is being formed which has provisionally booked orders for six additional steamers. There is thus an improvement in the shipping trade in every respect, and the general opinion in commercial circles is that we shall see a very much better autumn trade. Shipbuilders, we are informed, have many inquiries. One firm alone, in a single week, gave quotations [illegible] tonnage representing an aggregate value of £500,000.

New Dry Dock at Newport.—On September 11th the new dry dock which Messrs. Mordey, Carney & Co., Limited, have had constructed at their shipbuilding and ship repairing works, Uskside, was formally opened. A gaily-decorated steamer, the *Portugalete*, owned by Messrs. Morel Bros., of Cardiff, was the first vessel to enter. The Mayoress (Mrs. Mordey) was presented by the contractor with a pair of silver scissors, and with these the ribbon stretched across the dock entrance was severed. The new dock was christened the Mary, after the Mayoress. The other two smaller docks, which lie to the southward, are known respectively as the Edith and the Alice. The former is 220 and the latter 290 ft. long. The new dock is 350 ft., and would have been a few dozen feet longer, but not another inch could be eked out of the available ground. It will, however, receive a vessel of 350 ft., and its width and depth are 60 ft., and 32 ft., respectively. Four additional feet of water have also been obtained on the sill. The dock is concreted throughout, and has involved an expenditure of between £25,000 and £30,000. The river frontage of the company's works is over 660 ft., and every available foot of space is occupied with workshops, railways, and engineering appliances. The new dock lies nearest to a "pill," and this has been dredged and cleansed so as to deepen and lengthen it into a berth for vessels of 330 ft. long. It is 20 years since the Edith Dock, then 180 ft. long, was the sole possession of the then owners of the shipbuilding yard. Nine years ago the concern was converted into a limited liability company, and for the first year the turnover was five times as much as that of its predecessors. During the present year, as far as it has gone, 102 vessels have been docked at the yard, and 38 at the Alexander Dry Dock, giving a total of 140 vessels, with a tonnage of 200,000 tons. The new dock therefore is not without a *raison d'être*, as the company have been compelled to send 38 vessels to the Alexandra Dock. It should be added that Mr. J. Mackay, contractor for the Cardiff waterworks, has carried out the works, and that the engineers are Messrs. Jacobs & Pickwell, of Cardiff.

Boilermakers' and Shipbuilders' Society.—The new buildings which have been erected at Jesmond, Newcastle, by the Boilermakers' and Iron Shipbuilders' Society as head offices, were opened on September 22nd by Sir B. C. Browne. Over 7,000 members took part in a procession. The society was founded in the year 1843. Twenty years ago, when the present secretary took office, there were 94 branches, 700 members, and a fund of £9,000. Now there are 240 branches, 36,000 members, with a sum of £127,688 to their credit. Sir B. C. Browne, a large employer of labour on the Tyne, said the work trade unionism had done in the elevation, comfort, and improvement of the working classes was incredible, and it had done very little less for the consolidation and strengthening of trade. It was also of very great benefit to employers of labour. He doubted very much if it would be possible for the enormous enterprises of this country to go on as they did now if the workers were not organized so as to act with unanimity and on a system all through the country. If every two or three men here and there were to rise up and act independently of working men, competing one against the other, carrying the fetish of competition and the law of supply and demand to an unlimited extent, he did not believe that our great industries could go on at all. The Mayor (Mr. T. Bell) also took part in the proceedings.

The Italian Navy.—The most powerful marine engines in the world have been tried in the arsenal at Naples with entire success. Each set consists of four cylinders, steam being generated in 20 boilers, while the collective indicated horse-power is 20,000. They were designed by Mr. Seils, constructed by Messrs. Maudslay, Sons & Field, and have been fitted on board the Italian ironclad *Pe Umberto*. The commission nominated by the Government consisted of Captain G. B. Mirabello (president), Ing. E. Frigeri and Capo Machinista L. Miraglia (members), and Capo Machinista P. Caccuiola, as secretary. After the main engines were started, all the auxiliary engines were set in motion, so that at one time there were no fewer than 61 engines going. The commissioners were highly pleased with everything, and especially at the ease with which the immense engines could be handled. The Italians are only just ahead of us as regards the big engines, those for the *Blake* and *Blenheim* also of 20,000 horse-power, being well advanced towards completion. The *Sardegna* will shortly be launched at Spezzia, but the *Sicilia*, building at Venice, is much behindhand, and is still waiting for the cast steel stern brackets to arrive from England. The *Marco Polo*, protected cruiser, is well advanced at Castellamare, and will be ready for launching in August next year. But with this exception there is only one new vessel laid down in the Government dockyards, and she will be a cruiser of the *Dogali* type, but of rather greater displacement. She will be sheathed with wood for special use in the Red Sea, since it is found that the water there has a most injurious effect on the steel hulls if the vessels lay there for any length of time. She is building at Castellamare.

Shipbuilding in Norway.—On July 1 there were in the course of construction the following vessels in Norway:—At Nyland's yard, Christiania, five steamers of respectively 460, 38, 460, 700, and 56 tons. At Aker's yard, Christiania, five steamers of respectively 24, 76, 350, 80, and 4 tons. At Moss Iron Foundry and shipyard, Moss, two steamers of respectively 200 and 220 tons. At Frederikstad Engineering Works, Frederikstad, two steamers of respectively 195 and 130 tons. At Franmä's yard, Sandifjord, two steamers of respectively 540 and 500 tons. At Kristianssand two steamers of respectively 160 and 80 tons. At Stavanger three steamers of respectively 400, 325, and 325 tons; the two latter are at the Stavenger Iron Foundry and dock. At the Laxevaag Engineering and Shipbuilding Co., Bergen, two steamers of respectively 30 and 2,150 tons. At the Bergen Engineering Co., Bergen, two steamers of respectively 479 and 450 tons. At Rosendal's yard, Bergen, two steamers of respectively 250 and 450 tons. At Gravdal's yard, Bergen, one steamer of 200 tons. Further, at Burgen, four steamers of respectively 480, 450, 480, and 450 tons. At Aalesund one steamer of 300 tons. At Drontheim two steamers of respectively 130 and 40 tons. Aggregate of steamers: thirty-five with total tonnage of 11,662 tons. There were also on the same date in the course of construction 37 sailing vessels of an aggregate tonnage of 17,528 tons. Of these the greatest number were being built at the towns of Tvedestrand, Grimstad, and Arendal. Two of these sailing vessels were 1,500 tons or more, but the majority were between 400 and 600 tons.

Canadian Ship Railway.—It is proposed to connect Lake Huron with Lake Ontario at Toronto by a ship railway, thus shortening the route by the great lakes. Such a railway would save about 400 miles of lake navigation, and 28 miles of canal between the head of the lakes and Montreal. Besides the saving in lake and canal navigation, there would be the additional advantage of a cooler passage for grain from the north-west to the seaboard by the St. Lawrence than by the way of Buffalo, while by the new route three days would be saved, moreover, between Duluth and the Atlantic, not to mention the fact that by the Canadian route an Atlantic port some 100 miles east of any reached by the American route would be made. The length of the proposed ship railway would be 69 miles. The highest point in the ridges to be crossed by the railway would be 664 ft. above the level of Lake Ontario. The heaviest grade south of the ridges would be 30 ft. to the mile (one in 176), and north of the ridges 20 ft. to the mile (one in 264), the greater portion having long grades to the summit. There are to be lift locks, with protecting harbours, at each terminus, and four turntables at certain points along the route, with sidings to enable vessels to pass each other. There are to be three railway tracks of the ordinary 4 ft. 8½ in. gauge, the rails to weigh from 100 lbs. to 110 lbs. per lineal yard. The ship railway, it is estimated, would be able, with three large locomotives, to transport a vessel of 2,000 tons burthen (vessel and cargo) at the rate of 10 miles an hour, or seven hours for the whole distance (69 miles). The total cost of the ship railway is put at 12,000,000 dols., or about half the outlay for a ship canal of the same capacity.

The Mersey Bar.—Operations have commenced with the view of deepening the Queen's Channel, the chief entrance to the port of Liverpool, by removing the bar which has for so long a period proved such an obstacle to the entrance of the Mersey. A powerful dredger, fitted with sand pumps, is now operating on the great bank of sand at the mouth of the Mersey, 1,000 ft. in extent, and through this ridge of sand it is thought to make a deep-water channel where there is now only 11 ft. at low water, thus obviating the delays now so frequent in the passing into the port of larger vessels. Two centrifugal pumps, with 18 in. diam. suction pumps, have been fitted to the Dock Board's mud-hoppers of the most approved type, for removing sand, and it is calculated the channel will be so much improved that in 12 months 18 ft. depth will be obtained. Ten thousand pounds is the estimated cost of the work.

Shipbuilding at Barrow.—The Naval Construction and Armaments Co., Barrow, have received an order for the construction of a steamer for the West India and Pacific Steamship Co., Liverpool. She will be 318 ft. long, and 3,000 gross tonnage. The company have also secured an order from Messrs. Elder, Demster & Co., Liverpool, to build a small steamer. This makes five new orders placed at Barrow during the present month, consequently there is a prospect of a brisk winter's trade with the orders already in hand.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from August 16th to September 15th, 1890.

12951 Sir C. H. A. F. L. Ross. Governors for motive power engines.
12953 A. C. Engert. Steam boiler furnaces.
12965 C. W. J. Nolte. Steam boilers (M. Finkelstein, Russia).
12980 M. Dunlop. Steam traps.
12991 C. Stauss. Smoke consuming in boiler furnaces.
13022 A. Browne. Steam vessels.
13047 J. Baird. Steam engines.
13080 W. H. Foster. Sight feed lubricators.
13116 E. Latham. Evaporator and condenser for steamships.
13143 G. Chapman. Propellers for vessels.
13238 E. Petersen. Tubular steam boilers.
13385 J. B. Petrie and J. Petrie. Steam boilers.
13432 E. Edwards. Boilers (E. Willmann, Germany).
13451 R. Goodbody. Sight feed lubricators.
13487 J. Y. Johnson. Valves (J. Stoll, France).
13533 R. Morris. Propelling vessels by reciprocating plungers in cylinders, air, and valves.
13639 W. H. Ibbetson and A. S. Rowntree. Stuffing boxes and metallic packings therefor.
13655 G. Love. Regulator for marine engines.
13663 D. S. Heys. Steam boilers.
13784 J. Rethy. Steam boilers.
13837 B. Binnington. Propelling vessels.
13854 R. Edwards. Steam boilers.
13875 J. Mills. Marine steam boilers.
13908 J. J. Tinker. Steam Generator.
13954 F. B. Welch. Marine Boilers.
14048 J. MacFarlane Gray. Furnaces of steam boilers.
14062 J. Chetelat. Condensers for steam-engines.
14078 R. Wallbank and J. Pollitt. Steam boiler furnaces.
14096 J. O. Novello. Propelling ships.
14154 T. Shepherd. Piston rings for steam cylinders.
14178 K. Wright. Propulsion of vessels.
14198 R. Byrom and T. Bayley. Steam boiler furnaces.
14315 W. Buckley. Steam or other motive power engines.
14334 J. Richardson and William Norris. Valves of pumps.
14357 J. W. Newall. Screw propellers.
14385 J. H. Hopwood. Steam boiler furnaces.
14415 J. Wescott. Stop valve for steam and other fluids.
14430 J. Watt. Steam boilers.
14462 H. J. Barrett and W. Rumble. Boilers for steam-engines.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

Extra First Class.

September 13th, 1890.	Bromley, John..	Extra 1C	South Shields
,, ,, ,,	Parker, Thos. B.	Extra 1C	Glasgow
,, 20th, ,,	Hughes, H.	Extra 1C	London

August 23rd, 1890.

Athey, Wm. Tho.	1C	Cardiff
Bargery, Sid. C.	1C	,,
Beynon, John R.	2C	,,
Blackwell, Fk..	2C	,,
Bowden, Jas. Th.	2C	S'ampton
Busch, Geo.....	1C	Cardiff
Cameron John	1C	London
Charles, Dav. B.	2C	Cardiff
Clapham, Wm..	2C	N.Shields
Coleman, Syd. R.	2C	Cardiff
Cullen, George..	2C	Glasgow
Donkin, Robt...	1C	W.Hartpl
Evans, Wm	2C	London
Evans, W. J....	2C	Cardiff
Fiddis, Wm	2C	L'pool
Forsdike, Wm..	2C	Cardiff
Gibson, John H.	1C	N.Shields
Guyan, John J.	2C	Aberdeen
Hansell, Robt S.	1C	W.Hartpl
Howells, John..	2C	Cardiff
Hynd, Alexr. ..	2C	Glasgow
Jorstad, Ingebgt.	2C	N.Shields
King, Wm.	1C	Glasgow
Low, Robt.	1C	N.Shields
Macpherson, F.S.	2C	Cardiff
Mann, Robert ..	2C	London
Meares, Richd. S.	2C	Glasgow
Moore, Cuthbt. C.	2C	N.Shields
Mundell, Thos..	1C	W.Hartpl
Paige, John B..	1C	Glasgow
Parker, Tom S.	2C	Cardiff
Payton, F. Geo.	1C	,,
Ritchie, Arth. A.	2C	N.Shields
Souter, Wm. W.	2C	London
Stanton, Arthur	1C	,,
Taylor, John ..	2C	L'pool
Turnbull, Andw.	2C	Glasgow
Tweddell, Hy. A.	1C	W.Hartpl
Watson, John M.	1C	Glasgow
Woobank, Jos'ph	1C	Cardiff
Wrightson, Cha.	2C	W.Hartpl
Young, Wm. J.	2C	,,

August 30th, 1890.

Aird, Henry....	1C	Sunderl'd
Alder, Ralph ..	1C	,,
Armstrong, John	2C	N.Shields
Bloomfield, Jas.	2C	L'pool
Boulton, Thos..	1C	,,
Burnett, John..	1C	Sunderl'd
Campbell, A. C.	2C	,,
Campbell, Colin	1C	L'pool
Chivers, Henry	2C	London
Coghill, Alex. M.	2C	N.Shields
Corvie, John ..	2C	L'pool
Davison, Geo. A.	2C	Sunderl'd
Ellis, James A.	1C	L'pool
Evans, Wm. C.	2C	Cardiff
Gowland, Ed. ..	2C	Sunderl'd
Hay, Isaac Geo.	2C	London
Hellawell, Jn. W.	1C	L'pool
Howick, Hy....	2C	,,
Jenkins, Ed....	1C	Cardiff
Lindsay, Alfred	2C	Sunderl'd
M'Kenzie, W. R.	1C	L'pool
Molyneaux, Jas.	1C	,,
Oliver, Thomas	1C	London
Palmer, John ..	2C	L'pool
Parfitt, Geo. W.	2C	Cardiff
Patterson, T. B.	2C	Sunderl'd
Prole, Fredk. W.	2C	Cardiff
Rewcastle, John	2C	N.Shields
Robson, Tho. H.	2C	,,
Shore, Wm. C.	1C	,,
Smith, Jos. John	2C	Sunderl'd
Spray, Wm. Hy.	2C	London
Stonebanks, E.E.	2C	N.Shields
Vickers, John S.	2C	London
Walker, S. H. ..	1C	N.Shields
Wass, Alfred ..	1C	Sunderl'd
Wilkinson, E. ..	2C	,,
Williams, Evan	1C	Cardiff
Williams, T. F.	2C	L'pool
Wright, Ed. R.	1C	N.Shields
Young, A. J. P.	2C	L'pool

September 6th, 1890.

Bell, Geo. H. ..	2C	N.Shields
Best, Herbert ..	1C	L'pool
Caldwell, David	1C	Glasgow
Cowan, James..	1C	,,
Cowan, Samuel	2C	Dublin
Crosby, V. de P.	2C	Glasgow
Davies, Tho. W.	2C	N.Shields
Elliott, J. Edwd.	1C	,,
Elliott, Robert	2C	,,
Flahavan, J. W.	2C	N. Shields
Fowler, John ..	1C	Leith
Godwin, H. J...	1C	Dublin
Graham, Thos.	2C	N. Shields
Holt, James B.	2C	,,
Lloyd, Edward	2C	London
Mackenzie, P...	1C	Glasgow
McFarlane, Jno.	2C	,,
McInnes, Alexr.	1C	,,
McLellan, Geo.	1C	London
Napier, Wm. J.	1C	Glasgow
Neill, Arch. W.	2C	Leith
Ramshaw, J. J.	1C	N.Shields
Redman, Wm.	1C	London
Rogers, J. S. ..	2C	Falmouth
Ruxton, J. Kerr	1C	Glasgow
Ryan, John ..	2C	N. Shields
Scott, Warwick	2C	,,
Taylor, Benj. ..	2C	,,
Van Holhtoon, L.	2C	Leith
Vos, Fredk. N.	2C	Falmouth
Wilkes, Chs. W.	1C	Hull

September 13th, 1890.

Appleton, T. F.	2C	Cardiff
Bullick, Rbt. W.	1C	N.Shields
Bryson, Robt. B.	2C	,,
Drysdale, James	1C	L'pool
Evans, Griffith J.	2C	Cardiff
Firth, Thos. ..	1C	W.Hartpl
Forbes, James..	2C	Greenock
Glen, Thomas ..	1C	,,
Grant, John ..	1C	W.Hartpl
Green, Joseph..	2C	L'pool
Hicks, Ernest J.	2C	N.Shields
Hurry, Alex. ..	1C	Greenock
James, S. Frdk.	1C	Cardiff
Jevons, Sam. E.	2C	L'pool
Lightfoot, Wm.	2C	N.Shields
Long, Wm. H.	2C	L'pool
Lyell, John ..	2C	Glasgow
Macfarlane, J.M.	1C	,,
McIlraith, John	2C	Greenock
McMaster, — ..	2C	Glasgow
Mitchell, Robert	2C	L'pool
Philips, Arthur	2C	,,
Robson, John ..	1C	N.Shields
Sandeman, A. M.	1C	London
Spencer, Geo. L.	1C	Cardiff
Turnbull, Geo. D.	2C	N.Shields
Watson, Wm. C.	1C	W.Hartpl
Wilkinson, M. L.	1C	N.Shields
Wilson, John F.	1C	,,
Wilson, Thos. A.	1C	L'pool
Woodruff, Geo.	2C	N.Shields
Wright, John ..	2C	W.Hartpl

September 20th, 1890.

Boothroyd, H. J.	1C	L'pool
Coull, Alex. B.	2C	N. Shields
Crabb, Robert ..	2C	L'pool
Craven, Henry	1C	London
Defty, John ..	1C	N.Shields
Ewing, James..	2C	Dundee
Forrestt, Robert	1C	N.Shields
Hadaway, Amos	2C	,,
Hassell, H. A. ..	2C	London
Hunter, James	2C	L'pool
Kearns, Geo. ..	1C	,,
Laing, Alex. ..	1C	London
Lee, David S. ..	1C	L'pool
Lewis, John R..	2C	,,
Malcolm, Wm.	1C	London
Matthew, Wm.	1C	Dundee
McFarlane, A. ..	1C	London
Murray, Geo. ..	2C	N.Shields
Philip, Robert..	2C	Dundee
Pile, Wm. ..	1C	N.Shields
Pullar, James ..	1C	Dundee
Russell, Peter. M.	1C	L'pool
Thompson, Geo.	1C	London

The Marine Engineer.

LONDON, NOVEMBER 1, 1890.

THE North-East Coast Institute of Engineers and Shipbuilders held their opening meeting of the seventh session in the course of the past month in the Lecture Hall of the Literary and Philosophical Society, Newcastle-on-Tyne. The well-known engineer and shipbuilder, Mr. Wigham Richardson, was introduced as President, in succession to Mr. F. C. Marshall, who has occupied that office for the last two years. We are glad to see from the secretary's report that the Institute is still in an eminently flourishing condition and is steadily progressing by an increase of members, associates, and graduates. The new President's inaugural address was of an interesting character, and, as is usual, was of a retrospective and historical character. Mention was made of the gratifying testimonials to the esteem in which the Institute is now held, viz., by a request of Lloyd's Register of Shipping for the Institute to appoint four gentlemen to assist their surveyors in the forming of the rules for the construction of ships and steamers. A further flattering event is that the Durham College of Science has called upon this Institute to nominate a gentleman to their chair of engineering and naval architecture. Mr. Richardson then dilated at some length upon the necessity of engineers considering the well-being of their fellow countrymen in utilising modern science in boiler and furnace construction for the prevention of smoke. He quotes the authority of Lord Armstrong in conjunction with that of Mr. Longridge and the late Dr. Thomas Richardson, that so far as the raising of steam is concerned the production of smoke is unnecessary and inexcusable, and he refers with much truth to the obvious smoky condition of our Midland and Northern districts, where iron works and factories are concentrated, where a grimy black pall hangs as a disfiguring veil over much of the finest and most picturesque agricultural land in the country. Mr. Richardson was strongly of opinion that this evil was to be remedied, and in confirmation of this he might well have referred to our experience in London, where the "Smoke Prevention Act" is rigidly enforced and smoky atmospheres, except in the outlying districts where the Act is not in force, are exceptions. He pointed out that engineers should not be satisfied with this, since the fumes of alkali works have for many years been a curse to vegetation, and that latterly the stringent application of the "Alkali Fumes Act" is already beginning to bear fruit in an improved appearance of vegetation. Forced draught may make a radical alteration in the consumption of smoke, and a saving in expense, for the high and unsightly chimneys at present in use will not then be required. It is to be hoped from many successful experiments that are at present being made, that chemical treatment of escaping furnace fumes will be even more successful than any methods at present known for the prevention of the escape of chemical fumes or smoke into the atmosphere. The President quotes the results of some experiments carried out by a Mr. Mond, of the firm of Brunner, Mond & Co., who, it is understood, has succeeded in treating the waste products of fuel so as to obtain a valuable by-product. It is understood that by the use of 25 per cent. excess fuel to give same evaporation he recovers by a washing and condensing of the hot gases from the furnace four tons of sulphate of ammonia from the burning of 125 tons of coal. As fuel in colliery districts is exceedingly cheap, say five shillings per ton, and sulphate of ammonia is worth £12 per ton, the by-product so obtained will more than pay for the whole fuel consumed, and the day of wasted smoke and alkaline fumes is past. The late Sir William Siemens has dealt with the same question, and has showed that if coal were freed from its by-products it would be a better fuel as a fuel, and the by-products themselves would be worth twice as much as the original cost of the coal. The President then directed attention to the marked success of the Suez Canal in spite of many forebodings of disaster by which it was regarded by eminent English engineers. The unsuccessful Panama Canal was commented on, and the present Nicaragua Canal which the Americans are now at work upon. The Manchester Ship Canal, which is rapidly approaching completion, was of course not forgotten. Steamers have already been built with masts arranged to go under the bridges. Birmingham is now agitating also for a ship canal to the sea; and it is possible we may see the Irish Sea joined to the German Ocean. In marine engineering progress it is to be noted that shipbuilding has increased enormously of late in our country, so much so as to be the envy of our neighbours, some of whom have attempted by bounties and other fiscal measures to induce their own subjects to build their ships at home. Steel is rapidly replacing iron. Mr. Richardson apparently considers he has good grounds for criticising Lloyd's rules for the framing of ships, which he considers are unfortunately and unintentionally a premium on inferior models. It is to be hoped that the engineering and shipbuilding representatives upon the sub-committee of Lloyd's will be in a position to take such matters as these up and help to put them right. In naval architecture the President drew attention to the improvement in the system of testing by weight the initial stability of vessels, and he considers that views are much clearer than heretofore upon the resistance of a ship propelled through the water. Sectional displacement was considered some 30 years ago to be the governing factor in such resistance, whereas from the investigations of the late Professors Rankin and Froude, and the clear definitions of Mr. W. F. White, surface has been generally recognised as the most important factor in resistance. It may be important to note that displacement as a rule means nothing more nor less than surface, and is an expression peculiarly convenient to ship designers. The fact that as you increase the dimensions of a vessel you increase the displacement as the cube of the dimension and the resistance as the square only, throws a light on the satisfactory speed results attained by large steamers. At high speeds the law of resistance seems to be much more complex, and the only reliable method at present for attaining results seems to be limited to direct tests upon models. The President concluded with a few further remarks upon technical education, and took a very common-sense view in defining the claims of science as superadded to practical experience.

THE labour disputes which have raged since about the middle of September in the West of Scotland iron making industries, resulted about a month ago in the blowing out of almost all the furnaces of any consequence, and the universal lock-out of union furnacemen. The struggle between men and masters has now entered upon its most acute stage, and there is as yet but little indication of either party being wishful of a settlement. The question of the reduction of and compensation for Sunday work, although not the real cause of the dispute, is yet the occasion of the present critical situation. The furnacemen of the Scottish "Black Country" have been encouraged in their uncompromising attitude by the moral and material support of their brethren south of the Border, but the rubicon having been passed in the matter of extinguishing the furnaces, it does not now seem likely that any settlement of the difficulty can be arrived at which does not involve many weeks, if not months, of waiting, and an adjustment of matters lying outside the sphere of ironmasters and furnacemen altogether. The matters in question are concerned with the output of coal and the length of the working day of the miners. There is now quite an evident desire on the part of the miners to resort to the "short darg" system, the principle of which is to restrict supply and sustain selling prices, thereby it is thought keeping up wages. Whether this theory be correct or false it is not our province to discuss, but it is without doubt this state of matters which will have to be faced and rectified before either men or masters can hope to see matters back into progressive channels. Meanwhile it is not only the ironmaking industry that is being hindered and paralysed, but countless allied industries as well. Upon the full activity of ironworks, in fact, depends the subsistence of thousands of persons, from engineer to quay labourer and from shopkeeper to message boy. The steel trade of the West of Scotland, which has attained such vast proportions in recent years, is beginning to be hampered by the failure of the supply of "pig," on which it so largely depends; and it is regarded in well-informed quarters as by no means improbable that the steel works may be obliged to suspend operations altogether as a result of the present crisis. There can be no doubt that the miners' policy of short darg and idle days is beginning to prove fatal to the whole West of Scotland. Already orders for coal are passing away daily from the district to quarters where delivery can be guaranteed. Already ironworks rest in silence and stagnation under a canopy of gloom never before experienced during the whole history of the industry, and pig-iron is being sought in countries which have not hitherto contributed to the stocks of the West of Scotland. Without doubt the sense of justice, as well as the material interests, of all outside the ranks of the disputants in the present crisis, will rally to the side of the masters—not perhaps in dictating wages, but in stipulating that whatever be the rate of wages, the men shall contract to work a full day's work over a full working week. Without some such specific it seems quite hopeless to expect that the West of Scotland, or any other community, can maintain its position in the race of competition.

THE position of the shipping trade at the present time is most unsettled and critical. The partial success obtained by the dockers in London last year and at various ports since seems to have turned the men's heads, so that they are no longer even reasonable. The declared policy also of the various Unions in the shipping trade to support one another, whether directly interested or not, and their joint efforts to oust out all free labour, has opened the eyes of owners and capitalists to the very serious danger that menaces the trade generally. It has become evident that where "Union" labour has the power there is no definite limit to their demands. Messrs. Allan Brothers & Co. have found the most dangerous characteristic of combinations of uneducated masses: that there is no power which can control them against what they consider to be their immediate interests, and as they are perfectly irresponsible individuals, that cannot be effectively attacked for breach of contract, all contracts are merely idle words to them when they conflict with their personal interests. Messrs. Allan Brothers & Co.

have done their best to try and meet the new conditions by contracting direct with the labourers at piece prices through their Union, without the intervention of stevedores or middlemen, so that the workmen should have the fullest benefit from the sums paid. Upon a disputed point for extra "dust money," referred, according to agreement, to an arbitrator, the men have afterwards refused to abide by the decision of the arbitrator. What can be done with such men? They cannot be bargained with, as they will not stand to their pledges. To face this serious question, the Shipping Federation are at their wits' end. They have issued a circular to their various branches throughout the country to convene district meetings to discuss a possible general lay-up of vessels shortly, so as to have reliable information as to the feeling of each district with reference to this most important matter. That such a step is of the most serious character is acknowledged by all, but undoubtedly the consideration of the step has arisen from the feeling that a severe operation is frequently the safest and only issue from a lingering disease, serious and dangerous as the operation may be. The present constant conflicts with labour whether successful for one side or the other is exactly the condition of affairs to spoil business. If these matters go on unchecked, foreign shipping competition is incited. English bottoms may be transferred to foreign flags if they do not pay, and gradually the carrying trade may leave England, as much of her manufacturing trade has already done. In the conflict the owners and companies will be gradually bled to death and thus eventually have no stamina for a final and decisive struggle. It is difficult, however, to see what a general laying up of vessels would effect. Could a week or two settle the question, the dreadful burden might be borne. But the Briton has a wonderful staying power on semi-starvation, and the conflict would be prolonged. England would be starved out as a nation with a few weeks' interruption of her shipping trade. It is hardly likely that such an extreme course would be adopted until matters were more unbearable than at present. Why not organize a Free Contract Labour League, providing special advantages to the members in the shape of benefit funds in cases of sickness or when out of employment. Attention has lately been drawn to the fact that every year 8,000 men are discharged from the ranks of our Army who are unencumbered with Union ties, who are stated to be heavily handicapped in their search for work, and who have the advantage of a pension income whilst they are getting skilled at any trade they may adopt. May not the awkward position now adopted by labour Unions arise from the fact that they are the outcome of an inimical spirit between labour and capital. The Unions give distinct benefits in sickness and when out of work. Had such Associations been more fostered and originated by employers for benefit purposes they might never have taken up the strike policy as at present. It is authentically reported that one well-known Atlantic company has individually decided to lay up its steamers for the winter as they arrive, and that two other large Atlantic lines have decided to withdraw half their vessels and to maintain the service by running their steamers alternately. This will represent a withdrawal of something like a tonnage of 60,000 in Liverpool alone.

THE opening meeting of the Shipmasters' Society of London was held in the past month at the Society's room, 60, Fenchurch Street. The President, Captain H. F. Holt, delivered an inaugural address, in which he drew attention to the serious crisis through which the shipping trade is now passing with regard to labour troubles, and the coercion threatened by the amalgamated unions. He reported that the society was in communication with the new Shipowners' Federation, and that a sympathetic and mutual support had been effected between the two federations, both having been formed for like purposes and working for the same end, viz., "Freedom of contract and resistance to coercion." This action on the part of the Shipmasters' Society has caused a great amount of criticism both for and against their action. The President was of opinion that there could be no hesitation in the choice on the part of the shipmasters as to being under the control of capital and owners rather than under that of their own staff. He adds also some very sensible definitions as to the law of supply and demand, pointing out that any increase of remuneration artificially forced from capital or employers would soon fall to its proper limit as regulated by supply and demand. Captain Holt supplemented this general definition of principle with some excellent advice to the shipmasters as to making themselves more valuable to owners, and thus in a legitimate manner raising their market value. The progress of education has lately been so marked that it would be well for shipmasters not to remain satisfied with the standard of examination as now required as obligatory, but to seek by an increase of knowledge and dexterity to render themselves of increased and exceptional service to owners. It is to be remembered that the Board of Trade examination only professes to make a minimum standard necessary to command a ship, as so many men were at sea in command absolutely without any knowledge of navigation. Without doubt any marked excellence of professional ability will serve to distinguish shipmasters from shipmasters, and will secure for better men appointments of greater value in proportion to the value and responsibility placed under their charge. The President, therefore, desired to impress upon the meeting, particularly upon the junior members of the society, that they should not remain satisfied with a desired and obligatory certificate, since it represented only a minimum standard of knowledge, and such certificate may be acquired by mere cramming, or rote knowledge, without a grasp of the details of the shipmaster's profession, such as could be relied upon in an emergency. It would appear that many strandings occur from errors in nautical astronomy and from want of exactness in pilotage, where distances are often guessed at, instead of being ascertained by actual observation and measurement. The introduction of steam also has caused a new series of problems and conditions appertaining to vessels at sea with regard to which no shipmaster should now be ignorant, or how can a master assume control in that which he does not understand. A permanent feature of modern legislation is also to enforce responsibility against those occupying positions of authority, and where disaster and loss of life occur from reasons which might have been controlled by the person in authority, had he had sufficient knowledge to appreciate them, it is probable that in future the responsibilities of shipmasters will be more rigidly enforced rather than diminished.

AMERICAN MEETING OF THE IRON AND STEEL INSTITUTE.

THE following papers read at the recent meetings of the Iron and Steel Institute were the most of interest to our readers.

On the last day of the sitting at New York, Mr. Hadfield read a paper on "Aluminium Steel." He said that aluminium must play a considerable part in the metallurgy of the future. A metal whose specific gravity was only 2·6, a cubic foot of which weighed only 160 lb., against iron 440 lb., or silver, to which it had points of resemblance, 650 lb., tensile strength about ten tons per square inch, was inoxidizable in a high degree, and had high electro-conductivity, must have an assured and prominent future. Whilst the metal itself has proved so difficult of extraction, it was in its oxidized state to be found very abundantly in nature. Native metallic aluminium had not been met with. He found that aluminium had, in a considerable degree, a similar influence to that of silicon upon cast iron. There appeared to be much misconception as to whether its employment in the manufacture of steel or steely compounds was productive of good, and while the price remained so high, except in certain special cases, its application did not seem likely to become large. Aluminium appeared to be of most service as an addition to baths of molten iron or steel unduly saturated with oxides, and this in properly regulated steel manufacture should not often occur. Speaking generally, its *rôle* appeared to be similar to that of silicon, though acting more powerfully. His experiments had been made with practically pure aluminium, and if pure silicon were also obtainable its effect would probably be found to be almost the same. Mr. Hadfield then submitted the results of his experiments in a tabular form.

Mr. J. E. Stead opened the discussion. He had made a large number of experiments to ascertain the effect of aluminium upon steel, and also as to the nature of chemical reactions when aluminium was added to steel. His experiments clearly confirmed Mr. Hadfield that on adding aluminium to iron there was an increase in temperature. When added to cast iron free from any oxide of iron whatever, the temperature was very quickly increased. His experiments had proved that aluminium, when present in steel or in combination with iron, had power to reduce carbonic oxide, and in this respect it was similar to silicon, but very much more powerful as a reducing agent.

Mr. Percy Gilchrist said that he had been experimenting too with aluminium, and he could confirm most of Mr. Hadfield's points.

Mr. E. P. Martin wished to know how manganese had only slight, if any, welding properties. He himself had always thought, though probably he was mistaken, that manganese did assist in making steel weldable.

Mr. Hadfield, in reply, said that the more foreign elements present the more difficult the welding process. Both silicon and manganese hindered good results—that was manganese in excess of 1 per cent.

At the Pittsburg meeting of the Institute, Sir J. Kitson read a communication from Sir Henry Bessemer giving an account of his discovery of the process for manufacturing Bessemer steel, and the way in which he overcame the difficulties met with in its development. It was no exaggeration to say that without the Bessemer process for steel rail making the present railway system in the United States would not now exist, and the settlement of the new lands they had peopled and the binding together of the vast territory between the Atlantic and the Pacific under one civilised power would not yet have been effected. Sir James Kitson then referred to the researches of Mr. James Riley, M. Osmond, M. Brustlein, and Mr. Hadfield into the alloys of steel with other metals; and specially important was the use of nickel as an alloy of steel. The address was concluded as follows:—I have made mention of some of the men and of the inventions conceived and brought forth in our island home, and of the experimental researches which are being conducted by our metallurgists. You will see that we have need of many precious metals which your prolific country contains, to enlarge the properties of the materials demanded by our engineers, our army and navy, our ship and bridge builders. It is fortunate that we can make known these wants to men like the mining engineers of the United States, whose knowledge of those materials and their localities is as wide as their continent. We need those metals, we need also to feed and clothe our vast industrial population. For your grain and fruits, your cattle and cotton, your many remarkable mechanical devices, we have no precious metals to offer in return, but we have the products of our mines, the labour of our looms, the service of our mercantile marine. It is well that we should meet thus, eye to eye and voice to voice, to discuss the interests of the scientific aspects of the great industry which absorbs us. It is thus we learn that by persistent and intelligent labour how much has been accomplished, how much more remains to be achieved; and that by free exchange of ideas and of productions friendly understanding is promoted and personal acquaintance is built up.

Sir Lowthian Bell read a paper on "The Probable Future of the Manufacture of Iron." After referring to the ancient history of the iron trade, Sir Lowthian dealt with the so-called "direct process" which was thought by some likely to be a rival to the united power of the blast furnace and the Bessemer converter. In the Bessemer converter the combustion of the metalloids and a portion of iron sufficed to raise the bath of melted cast iron to a proper temperature for keeping malleable iron in a state of fusion. Attempt the same thing in a puddling furnace, rotating or otherwise, and the oxidation of the same metalloids and iron, producing the same quantity of heat as in the converter, required to be supplemented by the heat afforded by 15 cwt. of coal, in each case commencing with iron in a fluid state. The economy of the direct process had been argued upon thermal and chemical grounds; but the question of the capabilities of a reverberatory furnace, as compared with the united action of a blast furnace and a Bessemer converter, was perhaps best answered by the amount of labour required by the two systems. Our present "indirect process" cost in wages for the smelting and Bessemer processes less than one half of that paid in converting pig into puddled iron; and probably they would agree that if the reverberatory furnace should have to do the work of the blast furnace, this double cost might have to be doubled again. It was against the appliances which had enabled us to perform what might be regarded as a marvel of economy, against the blast furnace making 1,000 and even up to 2,000 tons in a week, and one or two Bessemer converters turning the whole into steel as the metal ran from the furnace, that a process which had practically made not one step in advance during the last 50 years ventured in our day to wage war. How was it that the direct process had up to this time ended in direct failure? It had also been proposed to accelerate the direct process, and for that matter a great many other things, by the use of water gas. The hydrogen element afforded above four times as much heat as the same weight of carbon, but, unfortunately, it required more than four times as much carbon to produce it. They might, therefore, as reasonably expect a hydraulic wheel to pump back all the water which had served to move it, as to hope to be able economically to burn any combustible twice over; for that was the impossible problem the water gas-makers asked them to accept as possible. In face of the admitted advantages in quality and cost of conversion of ingot over puddled iron, the fact that two-and-a-quarter million tons of ordinary malleable iron were made in 1889 in Great Britain might seem difficult of complete explanation. Should the day ever arrive when the labours of Bessemer, or Martin's adaptation of the Siemen's furnace for decarburizing pig-iron, entirely supersede the process of puddling, it must not be forgotten that the world owed to Cort an invention which had revolutionized the art of locomotion by sea as well as by land. Mention had been made of the hurtful effects of phosphorus in pig-iron for steel-making purposes. Unfortunately for Great Britain, its more extensive beds of ore were deposited at a geological period, when the prevalence of animal life served to concentrate in particular localities the element so much objected to by iron manufacturers. The basic process had eliminated the phosphorus, and Mr. Gilchrist informed him that the quantity of pig-iron treated in the Bessemer converter and open-hearth furnace during 1889 was close on 500,000 tons in the United Kingdom, and 1,174,000 tons in other parts of the world. The effects of the presence of foreign substances on the properties of malleable iron and steel were now universally recognised. This observation was more particularly directed to the injurious consequences which often resulted from the silicon, sulphur, and phosphorus which remained after the conversion of the pig-iron into these two forms of the metal. On the other hand, the service rendered by carbon in conferring increased strength and elasticity on iron could not be exaggerated. This fact had naturally led to the inquiry whether other elementary bodies might not assist, either in carrying out hurtful matter, or in increasing the valuable properties just referred to. Other problems connected with the resisting powers of steel, as they were affected by the manner of cooling, were also occupying the minds of those interested in the question. Among others, Mr. Ormonde had contributed important information in a recent communication to the Iron and Steel Institute.

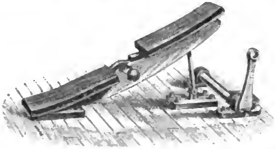
A paper, by Sir Nathaniel Barnaby, K.C.B., late Naval Constructor, was read on "The Protection of Iron and Steel Ships against Foundering from Injury to their Shells." The author stated that against the perils arising from perforation of the shells or hulls of ships we were greatly worse off in these days of steel and iron than we were when our ships were built of oak, teak, and pine. Apart from the greater risks arising from increased speeds and increased momenta in collisions, the material of which the hull was composed submitted so easily to perforation that the writer had numbered among his coadjutors in his profession eminent men who were strongly opposed to the abandonment of wooden bottoms both in commerce and in war. The ships in use and building for commercial purposes on the western side of the Atlantic were still constructed generally of wood. The large sailing navy of the United States might be said to consist almost exclusively of wooden ships. Of iron and steel sailing ships Great Britain owned considerably more than three-fourths of all that exist. But there could be no doubt that both in the United States and in Canada they must follow the example of Great Britain and build steamships almost exclusively of iron or steel. Size in a ship was an element of safety. A ship of small or moderate size was sometimes completely severed at the point of striking by the blow of a larger ship. An influential committee of Lloyd's, shipowners and others, sat in 1866 and decided to recommend that any two adjacent compartments of a ship might be given up to the sea without sinking the ship. No one had questioned that decision, and yet that recommendation had been absolutely ignored. Sailing ships generally had but one bulkhead. The man-of-war would probably never abandon the use of armour. They might rather expect that steel and steel-faced armour of the highest quality, instead of being confined to a few ships called battleships, would be employed universally for the defence of the absolutely vital parts of every ship built expressly for war service.

Mr. A. E. Seaton (of the Earle Shipbuilding Co., Hull) read a paper giving a sketch of the development of the marine engine and the progress made in marine engineering during the past fifteen years, which we print in full in our next number.

REES' BOAT DAVITS AND CHOCKS.

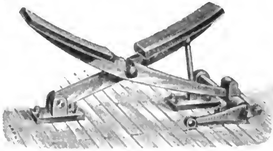
THE subject of boat-lowering at sea is one which has always been regarded with great interest, but never more so than at present, when the matter is engaging the attention of both shipowners and shipbuilders, and as the old, and as generally used the present, method has been found to be altogether inadequate, we have the pleasure of here describing and illustrating a system of boat davits and chocks, which will doubtless interest our readers.

The invention is that of Mr. Rees, the curator at the Royal Naval Museum at Greenwich.

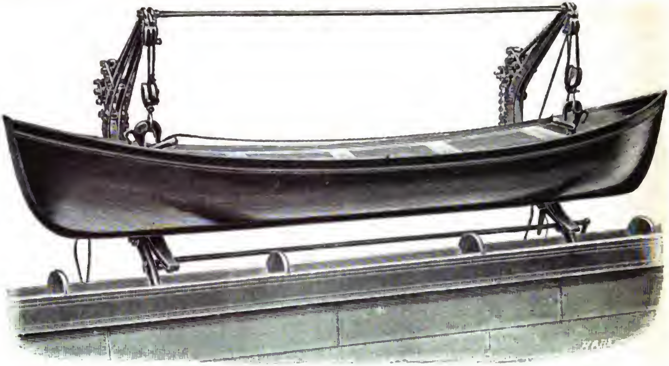


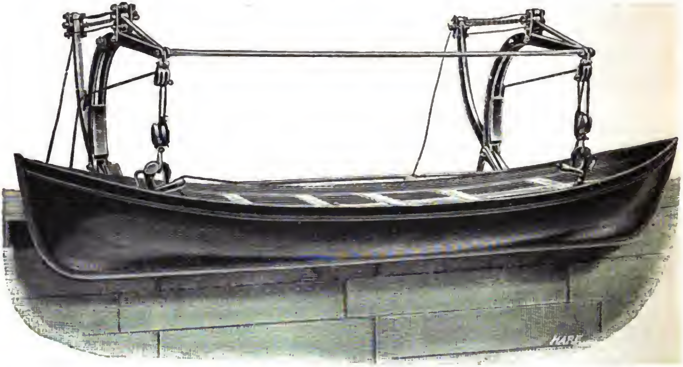
Mr. Rees is an old sailor of well-tried and great experience. He has had about forty years' actual service at sea, both in the Navy and mercantile service, and has been lowered some hundreds of times in all kinds of weather, both at night and by day, from the smallest craft to the three-decker. He has also given evidence before three Admiralty Committees on the subject of boat-lowering and disengaging gear, and we therefore think that his opinion on these subjects is worthy of the careful consideration of all concerned.

It is claimed for his gear that a boat of any size can, by its means, be put into the water by *two* men in less than a minute.



We have seen the working models, and, in our opinion, the great advantage of the system lies in the ease with which the boat can be lowered with safety by, as we have said, at most two men and by simply turning a lever, instead of requiring the services of about half-a-dozen men, at each end, to lift it off the chocks before it can swing in the davits, as is the case in ordinary methods. The weight of the boat likewise seems actually to do its own work and carries the arm out so that the boat is, at once, clear of the ship, where it is of course less liable to be smashed against the ship's side, as is now too often the case. Another advantage seems to be that the davits can be made considerably shorter and lighter, and we are informed that the price is not any more





than that of the ordinary kind. So effective is the arrangement that we learn that one of the firms who were supplied some time back with these davits and chocks have lowered a boat 30 ft. long by 9 ft. beam *over three thousand times* without a single hitch; and since this was supplied the gear has been much improved upon.

From our illustrations it will be seen that these patent davits consist of four parts—two fixed standards and two moving arms. The standards can be fixed outside the ship, or they can be fixed to the waterways or deck-houses, as the case may be, so as to suit all ships. These standards have two or more sheaves in the head of each. The moving arms are constructed of two steel plates, and are pivoted on a bolt to the standards just below the boat's keel, where also the releasing chocks are pivoted. Fitted on to the moving arms are blocks containing two or more sheaves to correspond with those in the heads of the standards, and through these are rove the topping lift falls for pulling out and pulling in the boat. The boat's falls are used in the ordinary way. The boat being at rest in her chocks, there is, from the point of suspension to the point of rest (*i.e.*, from upper to lower blocks), a slight angle inclining outwards, so that when the chocks are released, which is done by simply lifting the levers, the boat swings out. When these moving arms have got sufficiently far out for the boat to clear the ship's sides, they are checked by a preventer chain and the topping lift, so the boat, as we have said before, actually does its own work until it takes the water; and if fitted with disengaging hooks, it can be instantly released. When the davit guys are once set up they need not be touched, as when the boat is out they become perfectly rigid, thus obviating the necessity of having two men to attend them as at present with ordinary davits.

Illustration No. 1 shows the patent davits and chocks having the chocks released and the boat swung. No. 2 shows the davits swung out clear of ship's side ready for lowering. No. 3 shows the patent chocks fixed; and No. 4 shows the same chocks released.

The whole apparatus is extremely simple, and presents nothing liable to be deranged in use, and it has been approved of by captains of the ships to which it has already been applied, so that this contrivance which promises to overcome the old difficulty, is deserving of the careful attention of all captains and owners.

Messrs. Wm. Reid & Co., of 112, Fenchurch Street, London, are the sole agents for Mr. Rees.

ALUMINIUM BRONZE AS A MATERIAL FOR SCREW PROPELLERS AND OTHER MARINE ENGINEERING PURPOSES.

IT has been said that now that "aluminium brass, bronze and ferro-alloys are sold at comparatively low prices, it appears probable that there will shortly be a revolution in the manufacture of some of the materials used in marine engineering and shipbuilding," and although the Cowles Syndicate Co., Limited, of Milton, near Stoke-upon-Trent, have been but comparatively a short time engaged in carrying on their operations, they have already made considerable headway in creating the "revolution." This, we believe, is but partially realised by the engineering public, as in the initial stages of changes in practice in many establishments the greatest reticence is enforced. There is, however, no doubt that the Cowles Co. have had more experience with aluminium alloys than anyone else, and that they have succeeded in obtaining the adoption of their alloys in several of the most important engineering establishments in this country for many crucial purposes, and to an extent known only to a few privileged persons.

In addition to their electric smelting work, and the reduction of the oxides of aluminium and manganese, they have made a speciality of their aluminium and manganese copper alloys with the most satisfactory results, as will be shown in the course of this article. This success is due mainly to the scrupulous care exercised in all their operations. For instance, in connection with their preparation of alloys they have a special testing department, and are thus able, with the assistance of a large Wicksteed machine and a small Olsen machine, to guarantee the higher results now called for by Government and other specifications. Besides being adopted for screw propellers, to which matter we will make detailed reference, the alloys of aluminium have been found to be eminently suitable for many other purposes in marine and general engineering work, as well as for gun carriages, field guns, breech pieces, bearings, pump rods, hydraulic work, valve spindles, bolts, studs, dynamo work, and all parts of torpedoes. In all cases where a strong and superior bronze is desired these special alloys are being adopted with the most uniform and satisfactory results, and we make bold to predict that the Cowles Co. will find an ever-increasing demand for their special alloys, as materials of construction for the higher classes of engineering work.

In considering the suitability of aluminium bronzes for screw propellers, some reference must necessarily be made to other materials that have been and are being employed in their construction. In Table I. we give the results of comparative tests of transverse strength of cast-iron, steel, gun-metal, manganese bronze, and three special alloys of the Cowles Co. In Table II. will be found the detailed results of gradually-applied transverse tests to gun-metal, manganese bronze, and Cowles' No. 2 aluminium brass, the latter of which, from the various results, appears to be the ideal material for screw propellers. In Fig. 1 are shown curves of deflection, permanent set and resilience of gun-metal, ordinary manganese bronze, Cowles' Co.'s aluminium manganese bronze, and Cowles' Co.'s aluminium brass No. 2, a graphic comparison, showing at a glance the merits of the various materials.

It is well known that one of the most important characteristics of aluminium is that it is non-corrosive, so that, as compared with either iron or steel, aluminium alloys are undoubtedly superior materials for propellers, having a greatly minimised tendency to corrosion, whereas in the case of iron or steel propellers they are so rapidly pitted and destroyed at the outer end of the blades. As regards strength, limit of elasticity, permanent deflection and resilience (power to resist shock), aluminium alloys also compare favourably, more especially Cowles' Co.'s aluminium brass No. 2. This is apparent from the following Table No. I.

TABLE I.

MATERIALS FOR PROPELLERS

Comparative Tests of Transverse Strength.

Material.	Cross Section of Bar in inches.	Length of Bar between supports.	Breaking Load.	Limit of Elasticity.	Permanent Deflection.	Resilience. (Power to resist shock.	
						At Elastic Limit.	At Ultimate Strength.
Cast Iron	1 in.	12 in.	16 to 20 cwt.				
Steel	1 „	12 „	50 to 60 cwt.	Varies	Varies		
Gun Metal	1 „	12 „	26 cwt.	18 cwt.	3½ in.	·07	·13
Manganese Bronze (ordinary)	1 „	12 „	54 „	38 „	$3\frac{1}{16}$ „	·15	·23
Cowles Co.'s Aluminium-Hercules Bronze ..	1 „	12 „	56 „	50 „	3¼ „	·18	·24
Cowles Co.'s Aluminium-Manganese Bronze ..	1 „	12 „	61 „	56 „	1·8 „	·22	·25
Cowles Co.'s No. 2 Aluminium Brass ..	1 „	12 „	72 „	64 „	⅘ „	·2	·23

So far as strength is concerned, cast-iron and gun-metal, it will be seen, may be disregarded. It is also apparent that, as compared with the ordinary manganese bronze, the Cowles Co. mode of manufacturing their aluminium manganese bronze (which process is explained later on) ensures a much more suitable alloy for propellers, the breaking load being increased by 13 per cent., the limit of elasticity by over 47 per cent., with a corresponding decrease in the permanent deflection and increased resilience. Cowles Co.'s aluminium Hercules bronze also compares favourably with ordinary manganese bronze, more especially as to limit of elasticity and resilience.

It is, however, of greater importance to compare Cowles' aluminium brass No. 2 with ordinary manganese bronze, and in doing so reference may also be suitably made to the respective tensile strengths of the two materials. Manganese bronze (ordinary) has a tensile strength of from 25 to 30 tons in small bars, with 13 to 14 per cent. elongation, whereas Cowles' aluminium brass No. 2 has a tensile strength of 35 to 40 tons, with 5 per cent. elongation. As a matter of fact, these latter figures, which are the results of Cowles Co.'s own tests, have been more than corroborated by an independent test made by a large Tyneside engineering company, in which the tensile strength was found to be actually 41 tons, with 5 per cent. elongation.

The comparatively small percentage of elongation of aluminium brass No. 2 may appear to be objectionable, but this feature is not by any means necessarily disadvantageous to a first-class material for a screw propeller. No doubt, owing to manganese bronze having considerable ductility, it has been claimed that in case of an accident to a propeller blade of that material, *e.g.*, coming into collision with any substance harder or stronger than itself, it would probably bend, and if so can be, in most cases, bent back to its original form by hammering it cold, or by heating it to a red heat and pressing or hammering it. Against this, it may be as fairly objected, that this facility in bending is very disadvantageous, as if the propeller blade were bent to such a shape as to foul the after-post of the stern frame, the result might be either a serious breakage of the propeller shafting or engines, or the carrying away of the rudder and after-part of the stern frame.

Again, it will be noticed from Table I that there is a considerable difference between the limits of elasticity of the two materials and likewise in the respective permanent deflections. Cowles' Co.'s No. 2 aluminium brass has 68·4 per cent. higher limit of elasticity and only one-fourth the amount of permanent deflection of manganese bronze, so that a very much greater shock would have to be encountered by a propeller of the latter material before it would bend, whereas with a far less strain than would permanently deflect an aluminium brass propeller the manganese bronze propeller would be broken. To much the same extent are these advantages found on the part of aluminium brass in comparing it with cast steel—and, in addition, owing to the smoothness of surface, and the finer, sharper, and therefore more efficient blade, obtained with castings of aluminium brass, a great saving is effected by the reduction of skin friction and resistance, especially in the case of Atlantic greyhounds and similar high-speed steamships, war cruisers, torpedo vessels, &c. Further, in consequence of the toughness and greater fluidity of No. 2 aluminium brass, and also its resistance to corrosion, the thickness at the root of the blade at the centre of the sections can be made much sharper and finer towards the edges, and over the whole surface of the upper part of the blade, the thickness can be advantageously reduced. The exactness of form, as to pitch, &c., obtained in propellers cast of aluminium brass is also a very important feature, it being well known that steel propellers, in addition to being frequently rough and uneven, are distorted by the requisite annealing process.

The reduced weight of aluminium-brass propellers is no

TABLE II.

MATERIALS FOR PROPELLERS.

Comparative Transverse Tests, on Bars 1 in. by 1 in. by 12 in.

GUN METAL.

Stress Applied.	Deflection under Stress.	Permanent Set.	Resilience
8 cwts.	·03		
10 ,,	·045		
12 ,,	·06	·015	·045
14 ,,	·09	·04	·05
15 ,,	—	—	—
16 ,,	·15	·09	·06
18 ,,	·27	·20	·07
20 ,,	·46	·38	·08
22 ,,	·75	·65	·10
24 ,,	1·08	·97	·11
25 ,,	—	—	—
26 ,,	1·59	1·46	·13

Slipped through supports.

Permanent Deflection 3⅜ in.

ORDINARY MANGANESE BRONZE.

Stress Applied.	Deflection under Stress.	Permanent Set.	Resilience
8 cwts.			
10 ,,			
12 ,,			
14 ,,	·06		
15 ,,	—	—	—
16 ,,	·07		
18 ,,	·08	·005	·075
20 ,,	·09	·01	·08
22 ,,			
24 ,,			
25 ,,	—	—	—
26 ,,			
28 ,,			
30 ,,	·20	·075	·125
32 ,,	·23	·105	·125
34 ,,	·28	·140	·140
35 ,,	—	—	—
36 ,,	·34	·19	·15
38 ,,	·41	·26	·15
40 ,,	·49	·33	·16
42 ,,	·59	·425	·165
44 ,,	·70	·53	·17
45 ,,	—	—	—
46 ,,	·81	·63	·18
48 ,,	1·16	·96	·20
50 ,,	1·39	1·17	·22
52 ,,	1·70	1·47	·23
54 ,,		Fractured.	

Permanent Deflection $3\frac{3}{16}$ in.

COWLES CO.'S NO. 2 ALUMINIUM BRASS.

Stress Applied.	Deflection under Stress.	Permanent Set.	Resilience
8 cwts.			
10 ,,	·02	0	
12 ,,			
14 ,,			
15 ,,	·04	0	
16 ,,			
18 ,,			
20 ,,	·06	0	
22 ,,			
24 ,,			
25 ,,	·08	0	
26 ,,			
28 ,,			
30 ,,	·10	0	
32 ,,			
34 ,,			
35 ,,	·12	·01	·11
36 ,,			
38 ,,			
40 ,,	·15	·02	·13
42 ,,			
44 ,,			
45 ,,	·18	·03	·15
46 ,,	·19	·03	·16
48 ,,	·20	·04	·16
50 ,,	·21	·05	·16
52 ,,	·23	·06	·17
54 ,,	·24	·08	·16
56 ,,	·28	·10	·18
58 ,,	·31	·12	·19
60 ,,	·35	·16	·19
62 ,,	·40	·20	·20
64 ,,	·46	·26	·20
66 ,,	·54	·32	·22
68 ,,	·63	·40	·23
69 ,,	·67	·45	·22
70 ,,	·73	·50	·23
71 ,,	·79	·56	·23
72 ,,		Break.	

Permanent Deflection ⅜ in.

mean factor, having in view the recent *City of Paris* accident. In twin-screw steamers with fine lines, and necessarily long after-lengths of only partially supported shafting, any reduction of the weight of propellers, without reducing their durability or efficiency, is an important economical gain from a wear-and-tear point of view. As we have seen, aluminium No. 2 brass propellers can contain less metal, but in addition their weight is reduced, owing to the lower specific gravity of the material, hibitive, so that propellers cast of the most expensive, viz., aluminium brass No. 2, are absolutely cheaper than manganese bronze. In comparison with the *first* cost of cast steel, no doubt aluminium brass compares less favourably—but when all the circumstances are taken into account, the saving of weight, the greater efficiency, the renewal of propeller blades owing to the corrosion of steel, or to breakage, with the consequent expenses and delay, in reality their cost is not greater.

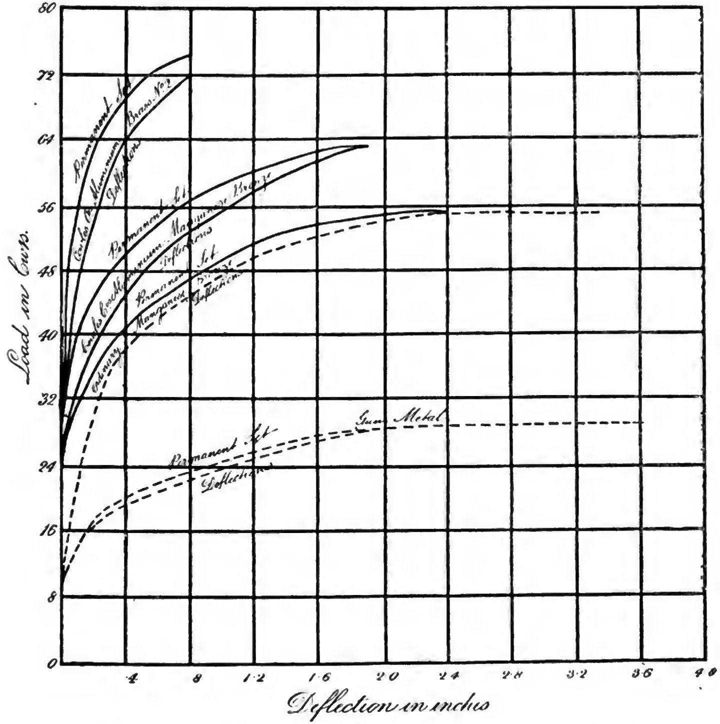


Fig. 1.

which is only 8·05, whereas ordinary manganese bronze is 8·34, so that in a propeller of say 15 tons weight—without any reduction in the thickness or otherwise of the castings, there would be a saving of 12 cwt. in the weight.

The item of cost, although secondary in importance, when absolute efficiency receives due consideration, does however bulk largely—and for the sake of the future of the aluminium alloys, it is satisfactory to find their cost is by no means pro-

It must also be remembered that an aluminium brass propeller, when the vessel is broken up, will realise a considerable sum as old metal, which is not the case with worn-out steel propellers.

It is important to note that already a number of steamships are at work having aluminium brass propellers, including a number of United States Government vessels of high speed, of which the war cruiser *Petrel* is specially noteworthy. Messrs. Exher, Wyss & Co., of Zurich, have also fitted a large number of small steam and naphtha launches with aluminium brass propellers, and in this country, a propeller cast by the Cowles Syndicate Co., Limited, Milton, Stoke-on-Trent, on being exhibited at the Exchange, Newcastle-on-Tyne, excited considerable attention. It has since been forwarded to the Imperial Institute at Berlin.

Having devoted so much space to No. 2 aluminium brass, a few words as regards the cheaper aluminium alloys must at present suffice. The Hercules bronze is very suitable for many purposes, having a tensile strain of 25 tons per square inch; and from 14 to 20 per cent. elongation aluminium manganese bronze stands midway between the Hercules quality and No. 2 aluminium brass, having a tensile strain of 30 tons, with 10 to 12 per cent. elongation, and from Table I. both will be seen to compare very favourably with materials in general use for propellers. They make good castings and forge excellently, hot stampings and bronze forgings being a speciality of the makers. As regards the aluminium manganese bronze, an important departure in the mode of adding the manganese to the copper and aluminium renders the material specially reliable.

Instead of the old process of making manganese bronze by the addition of spiegeleisen, by which procedure the bronze is deteriorated by the iron contained therein, the Cowles Co. in the manufacture of their aluminium manganese bronze use a pure alloy of manganese copper obtained by the reduction in their electric furnace of pure hydrate of manganese; and to this, with their aluminium-copper, obtained by the reduction of pure hydrate of alumina, enable them to produce an alloy having the highest possible qualities.

Sir Frederick Abel, on the occasion of his presidential address at the British Association Meeting at Leeds this year, said:—"The Messrs. Cowles have attacked the subject of the application of electricity to the achievement of metallurgic operations with the characteristic vigour and fertility of resource of our Transatlantic brethren," but it appears equally apparent that a similar energy has been displayed by the staff of the Cowles Syndicate Co., Limited, at their works at Milton, Stoke-on-Trent, who are ably assisted in the distribution and allied work by the sole agents, Messrs. Allen & Robson, 30, Dean Street, Newcastle-on-Tyne.

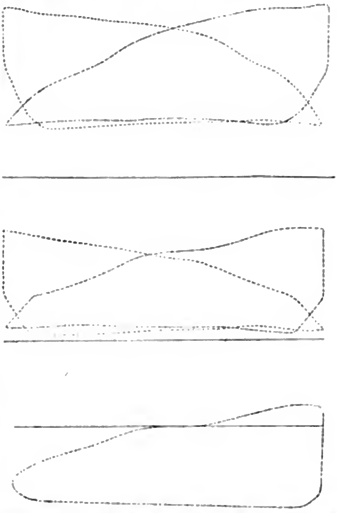
LIFE-SAVING APPLIANCES.

IN view of the coming into force of the Merchant and Shipping (Life-Saving Appliances) Act, on the 1st November, we have pleasure in calling attention to the specialities which Messrs. Thos. Proctor & Son, of Newcastle-on-Tyne, are introducing in connection with the Act, and which are designed to fully meet its requirements. The most important of these is the corrugated copper air-tight case for lifeboats, and its point of superiority over other contrivances of the kind consists in the corrugation, which gives the necessary rigidity to the tank, and permits interior staying to be dispensed with. This of course is a most important consideration, as by this arrangement lightness is secured, while the necessary strength is maintained. A combination of qualities is thus obtained, which, if desirable in anything, is pre-eminently desirable in a ship's boat, which may at any time be brought into requisition for the saving of human life. To facilitate the task of ordering from a distance, the firm supply a sheet containing measurement diagram and sketches, by which the method of taking the measurements required will be seen at a glance. The firm, however, can arrange to send their own men to take templates, when orders are received in respect of vessels lying at any of the north-east ports. The firm have already received a great number of orders for the air-cases, a fact which shows that among shipowners, as well as among inspectors and captains, their advantages are fully recognised. Among the firm's other specialities, designed to meet the requirements of the new Act, are their regulation cork jackets, life buoys and life belts, sea anchors, oil distributors, hatchets, bailers, compasses in wood boxes, as also in binnacle with lamp, brass globe lamps, water breakers, &c. It may also be mentioned that in addition to the foregoing, the firm are manufacturers of ventilators, cowls, galvanised tanks, ships' lamps, cabin stoves, &c., in all of which lines they hold a deservedly high reputation.

Shipbuilding Contract.—Messrs. T. R. Oswald & Co., Limited, of Milford Haven, have contracted to build a steel sailing vessel of 3,000 tons net register for a London firm.

TRIAL TRIP RESULTS OF THE STEAMSHIP "QUEENSLAND."

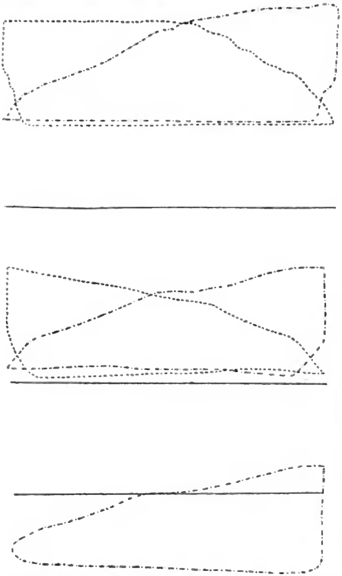
THE screw steamer *Queensland*, built recently by Messrs. Jos. L. Thompson & Sons, North Sands, Sunderland, to the order of William Kish, Esq., of Sunderland, had, before leaving on her first voyage with a cargo of 4,500 tons for Genoa, a carefully-conducted progressive trial trip on the measured mile at Whitley, and, by the courtesy of the shipbuilders and engineers, we are enabled to give the recorded results, as well as the diagrams taken during the runs. The engines are similar in design to 80 engines completed by Mr. John Dickinson, of Palmer's Hill Engine Works, Sunderland, which have in every instance proved eminently satisfactory. They are constructed on the triple-expansion, direct-acting, inverted cylinder principle, the high-pressure cylinder being 26 in. diameter, the intermediate cylinder 43 in. diameter, and the low-pressure cylinder 70 in. diameter, each having a stroke of 45 in. The two former cylinders are fitted with loose liners, the high-pressure having a piston valve, the intermediate and low-pressure cylinders being fitted with ordinary D type double-plated slide-valves. The valve gear is a modification of Bremme's gear, or, more accurately, Dickinson's arrangement of the Bremme valve gear, by which the steam chests are brought to the front of the engines, thus economising fore-and-aft space in the vessel by reducing the length of the engine-room.



Steam, 160; Vac., 27; Rev., 65; Mean Press., 71, 28·3, 9·95 I.H.P.; H.P., 556; M.P., 606; L.P. 557=1,719.

The piston-rods are of forged steel, and, as well as the slide-rods, are fitted with metallic packing, the crosshead guides being arranged for water circulation. The connecting rods are of wrought iron, with cast steel bottom end bearings, fitted with white brass. The condenser is of the usual box pattern, and has ample cooling surface. The bed-plate and columns are constructed of cast-iron, the bearings for the main shafting being made of a special mixture of cast-iron, and lined up with white brass. Dickinson's patented arrangement is adopted in the construction of the crank shaft, which is essentially a built-up one, and thus renders renewal of worn parts comparatively inexpensive. The crank webs and pins are of cast steel, and the remainder of the shafting of wrought iron, to which the webs are secured by bolts, the webs not being contracted on the main part of the crank shafts. This design of shaft has been fitted to about 250 steamers.

The thrust shaft bearing is of the horse shoe type, of large surface, and fitted with white metal rings, experience having shown that this arrangement gives uniformly satisfactory results. The bilge, air and feed pumps are driven by the main engines by means of a crosshead lever from the after engine.

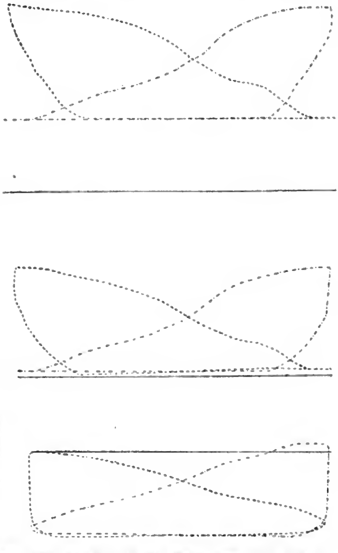


Steam, 164; Vac., 27; Rev., 67; Mean Press., 68·25, 28·8, 10·3 I.H.P.; H.P., 551; M.P., 637; L.P., 605=1,793.

The starting and reversing gear is of a simple character with no unnecessary complication of parts, and is arranged to work by steam or hand. A separate engine of similar design is also fitted for turning the engines.

On the trial trip the *Queensland* had a full cargo and bunkers—the displacement being 7,987 tons (block coefficient ·751) the draft of water being 22 ft. 4 in. forward, and 22 ft. 7 in. aft, or 22 ft. 5½ in. mean draft. The immersed area of midship section was 1,008 square feet, coefficient ·983. The courses on the trial trip were north and south, a northerly wind prevailing, the sea being comparatively smooth.

The results of five runs are appended, along with the respective Admiralty speed efficiency coefficients. These, as will be noticed, fluctuate considerably, and owing to there not being two runs at each speed, only afford an approximate idea of the relative speed efficiency. It is, however, apparent that the most economical speed for the vessel is under nine knots and probably over eight so far as the data permits of a conclusion—and which is in accordance with general practice with heavy deadweight carrying steamers. The corresponding diagrams taken during the trial trip are first-class examples, and show that the designing and construction of the engines reflects credit upon those responsible for the same.



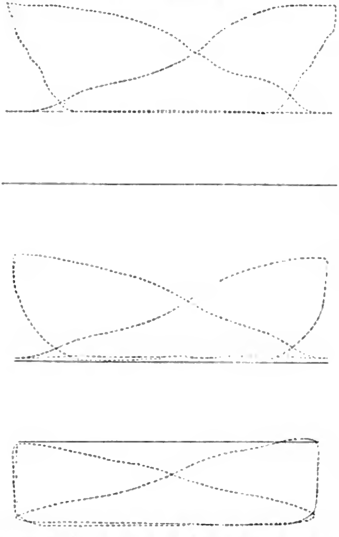
Steam, 156; Vac., 27; Rev., 56; Mean Press., 45·5, 22·3, 7·1, I.H.P.; H.P., 307; M.P., 411; L.P., 347=1,065.

Trial Trip Results of s.s. “Queensland.”

No. of Run.	Course.	Speed in Knots.	Indicated Horse-Power.	Speed Coefficients.	
				$\frac{V^3 D^{\frac{2}{3}}}{\text{I.H.P.}}$	$\frac{V^3 \text{M.S.}}{\text{I.H.P.}}$
1	North	9·80	1719	218·7	551·7
2	South	9·27	1793	177·5	447·6
3	South	8·91	1065	265·3	669·3
4	North	8·63	1028	249·8	630·0
5	South	6·42	521·5	202·7	511·3

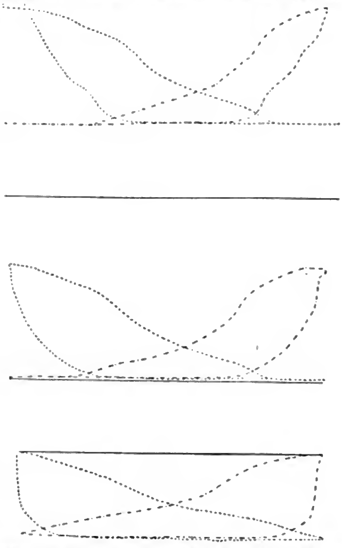
THE NEW CHILIAN TORPEDO GUN-BOATS.

WE have already given brief details of the main features of the two torpedo gunboats, the *Almirante Lynch* and the *Almirante Condell*, built by Messrs. Laird Bros., of Birkenhead for the Chilian Government. These vessels having now undergone their final official trials in a most successful and satisfactory manner, a more complete description of their special design and construction will be of interest. As the two vessels are sister ships, identical in all their general features, it will be only necessary to give a detailed description of one, and as the official trials both for speed and coal consumption of the *Almirante Condell* have just been completed, we have selected this vessel specially for our notice. From the description we have already given our readers will be well acquainted with the main features of these vessels, which represent a very considerable advance on anything that has yet been accomplished in perfecting war ships of this special class, and we will first give the result of the official trials, and then conclude with more ample and detailed particulars of design, construction, and armament. The official speed-running trials, after being delayed for several days owing to exceptionally bad weather, took place on October 4th, and even then the conditions were anything but favourable for obtaining the best results. Amongst those present were Rear-Admiral Latorre, chief of the naval commission; Captain Rodriguez, the commander of the ship, and several of the technical advisers of the commission; Mr. Rutherford, engineer-in-chief to the Chilian commission, and also a large number of executive, torpedo, gunnery and engineering officers of the Chilian navy, who carefully watched the proceedings; Mr. Hudson, as representing Sir E. J. Reed, the naval adviser of the Government of Chili, had attended the trials of the *Almirante Lynch*, and was, we understand, so satisfied that he did not deem it necessary to be present on this occasion. The British Admiralty were represented by Mr. J. H. Ellis, of the constructor's department of the Admiralty, and the Hotchkiss Co. by Mons. Benét. The Messrs. Laird were on board with a large number of their technical staff. Mr. Bevis, sen., was also present, and the machinery was in the charge of Mr. R. Bevis, jun. As already stated the weather conditions were most unfavourable. A strong gale from W.S.W. was blowing, causing a nasty sea, the waves being about twelve feet long. The party embarked from the Woodside stage, and going out to the bar, speed was gradually worked up preparatory to the three hours' run, with forced draught. The stokeholes and air locks were closed and the fans set to work. From the bar the course was set W. by N. ½ N. to the north-west lightship, and the engines were gradually worked up to full speed. Four consecutive runs were made between the bar and the north-west lightship, with the following results:—Mean draft of vessel, 9 ft. 0¼ in.; displacement, 710 tons; speed (mean of means), 20·313 knots, equal to 23·40 statute miles per hour; total I.H.P about 4,350; mean revolutions, 270; boiler pressure, 143 lbs., in engine-room, 138 lbs; pressure in I.P. receiver, 46 lbs.; ditto in L.P. receiver, 8 lbs.; vacuum, 27 in., air pressure in stokeholes, 2¼ to 2¾ in. The safety valves were lifting all the time. As we have said, the weather was very bad for the speed trials of so small a vessel. She was enveloped



Steam, 153; Vac., 27½; Rev., 54; Mean Press., 44·25, 21·3, 7·6 I.H.P.; H.P., 289; M.P., 380; L.P., 359=1,028.

Diagrams, *see page* 330.



Steam, 154; Vac., 27; Rev., 43; Mean Press., 22·1, 15, 5·16 I.H.P.; H.P., 114·5; M.P., 213; L.P., 194=521·5.

Diagrams, *see page* 330.

in clouds of spray when going against the wind and sea, but at no time did she ship any solid water. When running at this high speed against the short waves of the sea the vibration in the after end was considerable, but less than is usual in vessels of this class. At the conclusion of the runs, full speed was still maintained till the three hours were up. Exceptionally good as were the results obtained by the speed trials, they can only be regarded as approximate, owing to the unfavourable conditions under which they took place, and the officers of the Chilian Commission expressed the opinion that at least a quarter of a knot deduction of speed should be allowed for the bad weather under which the trials were made, so that the actual mean speed over the three hours' run may be fairly put down at more than 20¼ knots per hour, which is more than a knot greater speed than has been obtained by any vessels of similar construction that have hitherto been built. It may be interesting to add that whilst the *Rattlesnake*, the first vessel of this special class that was built for the British Government made in her three hours' trial a speed of 18·95 knots, this speed was increased over the measured mile trials to 19·45 knots, and it is only reasonable to suppose that with the *Almirante Condell* a measured mile trial would bring out similar results in an increased rate of speed as compared with the mean speed obtained in the three hours' trial. The credit of this splendid speed belongs of course to the power of the engines and the fine lines of the vessel. The skin friction is also another factor which materially influences the speed. In these high speed boats not a little depends upon the state of the vessel's bottom, and the *Almirante Lynch* and the *Almirante Condell* are coated with Messrs. Suter, Hartmann & Rahtjen's composition, which from its well-known enamel-like surface greatly diminishes the frictional resistance. The next proceeding was to test the mounting of the guns. This was done by firing five rounds from each in the presence of the Chilian officers. These tests were in every way thoroughly satisfactory, the decks showing no signs of straining whatever. A minute examination of the machinery and boilers, made by the Chilian Commission, a day or two after the trials showed that they were in perfect order, no trouble whatever being experienced with the boilers; in fact nothing at all throughout the whole of the machinery required attention in any shape. This, when the repeated breakdowns of war ships after their trials are borne in mind, must be regarded as very remarkable, especially in a vessel constructed to run at such exceptionally high speed as the *Almirante Condell*, and reflects the highest credit upon the builders, Messrs. Laird Bros., of Birkenhead.

The coal consumption trials were made on the 7th October. It is fixed by the contract under which the vessels are built that the coal consumption shall not exceed 100 lbs. of coal per knot when running for six continuous hours, at the rate of 11 knots. The result of the trial was a consumption of only 88 lbs per knot, and at this rate the vessel's normal supply of coal—100 tons—is sufficient to carry her for 2,800 knots, whilst her bunkers can contain, without overloading the ship, sufficient coal to enable her to steam more than 4,000 knots, at the speed of 11 knots per hour. The whole result of the trials is conclusive evidence of the eminently satisfactory manner in which Messrs. Laird Bros. have carried out their contract, and they can point to the *Almirante Lynch* and *Almirante Condell* with feelings of pride. To the Chilian Commission the manner in which Messrs. Laird have completed the contract has also, it is needless to say, given the greatest satisfaction, and Admiral Latorre, in replying to the toast of his health after the completion of the trials, congratulated Messrs. Laird on the success they had attained, referring especially to the excellence of the construction and the faithful way in which the contract for the building of the vessel had been fulfilled. It is not too much to say that these two vessels are certainly the best of their class that have yet been built, no other nation having anything equal to them, not only as to speed but also as to general perfection of design and construction. It may be added that Messrs. Laird have also supplied the armament complete, with ammunition; in fact the vessels leave Messrs. Laird's hands fully equipped in every respect. It is expected that the vessels will be ready for handing over in the course of a few days, and they will at once go under the Chilian flag in full commission.

GENERAL DESCRIPTION.

In designing the *Almirante Lynch* and the *Almirante Condell* the leading principles which were so successful in the case of the *Rattlesnake*, built for the British Government, have been generally adhered to, but the greater displacement of the two torpedo gunboats just completed for the Chilian Government has, of course, necessitated certain departures in detail. The displacement of the *Rattlesnake* is 550 tons, whereas that of the *Almirante Condell* is from 730 to 750 tons, and it approaches the *Seagull* class of vessel in dimensions and arrangements, but is better protected, and a superior seagoing boat in every respect. The many conflicting qualities, which are so essential in a vessel of the *Almirante Condell* class, such as high speed, floatability, great powers of manœuvring, guns of great ballastic properties, with the vitals of the ship efficiently protected, good bunker capacity and coal endurance, with sufficient habitability so as to ensure long cruises without endangering the health of the crew have been most judiciously combined, and the highest naval authorities have expressed their most complete approval of the two latest torpedo catchers designed and built by Messrs. Laird Bros., of Birkenhead.

Taking first the hull of the *Almirante Condell*, she may be described as a flush deck vessel with high forecastle and half poop. She (also her sister the *Almirante Lynch*) is 240 ft. long, 27 ft. 6 in. broad, about 14 ft. deep, and steel is used entirely in the construction of the hull. When at her normal draft she draws 8 ft. forward and 11 ft. aft, her displacement being 750 tons. She has a ram stem of steel, which is fitted with a bow torpedo discharge tube. The shape of the hull is such as conduces to stability and speed, and under water the lines are extremely fine. There is no external keel, but internally there is a deep keel plate, which is reinforced by a middle line longitudinal bulkhead. To diminish rolling two deep bilge keels are fitted. To reduce weight, and at the same time to ensure proper strength, the system of overlapping butts for the skin plating is adopted. From the load water line the sides amidships have a pronounced tumble home. When at the load draft the freeboard is midships about 5 ft. In the after end the deadwood is cut away to allow room for the balanced rudder. From the curved inner stern post are hung the two propeller brackets, which support the stern shafting and propellers. The stem is especially strengthened by stringers so as to enable it to be used as a weapon of offence. On the forecastle head are the two capstans, by Emerson, Walker & Co. for working the cables. These capstans are worked either singly or together by shafting and clutches placed on the main deck immediately below the capstans. The anchors are of Wasteney Smith's well-known make, and being stockless they stow up the hawsepipes, thus enabling the forecastle head to be kept clear of catting and fishing gear. Here, too, on the afterpart, is the conning tower, built of 1 in. steel plates, pierced with sight holes, and covered over with a steel hood, upon which is a flying bridge carrying the search light and the mounting for two Gatling guns. Inside the conning tower are the engine-room telegraphs, the steering telegraphs, steam steering gear, torpedo discharge and directing gear, voice tubes, &c. So that practically the commander can control by himself the movements of the vessel. Below the topgallant forcastle are the lamp rooms, w.c.'s, the crew's quarters, and the carpenter's shop. On the lower deck forward are the refrigerating machinery and store rooms for the torpedoes. On the lower deck, in the space between the second bulkhead and the fore boiler-room bulkhead are the dynamos and air-compressing engines. Ascending to the main deck, we find the forward boiler-room hatch coamings about three feet high. These are protected against plunging fire by steel armour plates over the gratings and armour bars. Abaft the forward boiler-room hatch is the galley; then comes the after boiler-room hatch, also protected; abaft this is the engine-room hatch. At the break of the poop and on the main deck is the armoured hood, enclosing a similar installation of engine-room telegraphs, steering gear, torpedo firing and directing apparatus, and voice tubes as is fitted in the conning tower. This hood is capable of being inclined laterally, so as to effectually shield the officer beneath it. Needless to say, sail power is entirely dispensed with, although, for sea service, a few staysails and trysails will probably be fitted. There are two masts, and the mainmast carries a light yard for signalling purposes. There are two funnels. The masts and funnels have a rake, which contributes to the graceful appearance of the vessel. The weakness which was manifested by the *Sandfly* and her consorts has been carefully guarded against in the *Almirante Condell*. It was found that in the former there was a deficiency in longitudinal strength. In the latter this has been avoided by the simple expedient of making the middle line longitudinal bulkhead a huge plate frame girder, in which the middle part, which is valueless for strength, has where necessary been cut away. In addition to the strength imparted by the longitudinal M.L. bulkhead, the vessel is further stiffened, and at the same time protected against the fire of light guns by an inch-thick strake of plating in the wake of the engine-room and boiler-rooms, extending fully two-thirds the length of the vessel. Strength and protection is further assured by the steel upper deck, which is sheathed with teak. Subdivision has been followed as much as possible, there being in all 45 water-tight compartments. The pumping power is very considerable for a vessel of this class. The centrifugal circulating engines can draw from any compartment if required. There are six ejectors, each capable of throwing 30 tons per hour. There is also a Downton pump of the Admiralty pattern for ordinary purposes, the total pumping power being 600 tons per hour. The two boiler-rooms are in separate water-tight compartments. Between the two boiler-rooms is a cross bunker, which partially extends over the boilers, thus ensuring good coal protection. Between the boilers and the ship's side are side bunkers, thus the coal protection is, on the whole, very good. There is an alley-way between the two boiler-rooms, fitted with an air lock. Between the after boiler-room and the engine-room is a water-tight bulkhead fitted with water-tight doors. There is also communication between the engine-room and the cabin, so that the officers can go through the engine and boiler-rooms into the fore part of the vessel without having to go on deck. The two engine-rooms are separated by the longitudinal M.L. bulkhead, in which is a water-tight door. Each engine-room and each boiler-room can be, and indeed is, effectually isolated. As might be expected in a vessel possessing such great reserve buoyancy, associated with good freeboard, the *Almirante Condell* and her sister, the *Almirante Lynch*, are exceedingly lively in their motions, and are veritable ducks in a seaway. The manœuvring power of these vessels is very remarkable. The twin screws, combined with large rudder area, enable the vessel to turn a complete circle in her own length. The steam power is supplied by four locomotive boilers, each with two furnaces, fitted with ribbed flues and water spaces under the ashpits. The working pressure is 155 lbs. per square inch. Each boiler is so arranged that it can be cut off from the rest, and in the event of shot disabling any one boiler there is a non-return valve fitted on to each steam pipe, so that the steam from the undamaged boilers cannot escape through the damaged boiler. The total heating surface is 6,000 square feet, and the fire-grate area is 190 square feet. For ordinary purposes natural draught is used, but when required forced draught is resorted to. As the boiler-rooms are in water-tight and air-tight compartments, an air pressure of 2½ in. is easily maintained by four fans driven by Allen's high-speed engines. A device which Messrs. Laird have introduced is that whereby the suction of the after fans is led into the engine-rooms, thus exhausting the heated air and passing it to the furnaces. This effectually ventilates the engine-rooms, which are comparatively cool considering the necessarily large radiating surface and the small space. The engines of the *Almirante Condell* are duplicates of those for H.M.S. *Speedwell* and *Skipjack*. They are triple-compound, with cylinders 22 in., 33 in., and 49 in. diameter, and a stroke of 1 ft. 9 in. The steam from the H.P. cylinder passes through pipes to the I.P. cylinder, and again through pipes to the L.P. cylinder, there being no receivers, properly speaking, although the pipes act as such. The valve motion is of the ordinary Stephenson kind, the links being of the double bar type. In the main engines there are no departures from the best practice, and we note that the distinguishing characteristics of Messrs. Laird's engines are repeated. The cylinders are bolted together and carried on bright-turned steel columns, braced by diagonal stays, and also by stays to the deck beams and to gusset frames in ship's side. Piston valves are used for the H.P. engine, but the ordinary D slide for the I.P. and L.P. engines. In engines such as these, developing such high power and running at a high number of revolutions, there is always a difficulty in getting the steam away fast enough from the L.P. receiver. The steam here is now expanded down to an attenuated form, with accompanying increase in volume. This necessitates large port area and a large slide valve. Even with the smallest factor of safety it is impossible for such a valve to be less than 5 cwt. in weight, and when this weight is reciprocating at the high speed mentioned it is obvious that there is here a considerable expenditure of power. Messrs. Laird have introduced an arrangement which we think will be largely imitated. It is, of course, an old practice to balance the valves of marine engines, but in the *Almirante Condell* the valve spindle of the L.P. engine is prolonged, and is fitted with a piston which works inside a small steam cylinder. Steam is admitted to either side, and is exhausted by means of a small kicker slide valve worked on the same principle as are the valves in the Westinghouse and other straight line engines. The result is that the eccentric sheaves in the L.P. engines have little else to do than to determine the admission, and cut off, and exhaust. The reversing gear is both hand and steam of the all-round type. There is no bed-plate for the engines, properly speaking, but the framing and main bearings are carried on deep longitudinal girders secured to the framing of the ship. While, of course, weight has been reduced as much as possible there is no sacrifice of strength. All the bearings are very long, and all moving parts of ample cross section, and, by a judicious distribution of ties and stays, anything like undue vibration is quite absent. The guides for the piston crossheads are attached to the columns. The surface-condensers, together with their tubes, tube plates, and supporting diaphragms are of copper, placed horizontally, one abaft each set of engines. The air pumps are vertical single-acting, worked by levers from the piston crossheads of the low-pressure cylinders. The circulating pumps are centrifugal, driven by independent engines by Allan. Another very ingenious arrangement adopted by Messrs. Laird is that of working the feed pump with the same engine that drives the centrifugal pump. The spindle of the latter is prolonged, and in it is a worm which gears into a worm wheel. Placed at right angles on the shaft carrying this worm wheel are keyed two cranks, one at each end. These are joined up to the feed-pump plungers. The ratio between the speed of the centrifugal and the feed pump is 6 to 1. The arrangement is exceedingly compact, and a considerable saving in weight and space results. There is in each engine-room one of Kirkaldy's feedheaters and distillers. This useful apparatus occupies a remarkably small space, and is very compact. Messrs. Kirkaldy have made the subject of distilling a speciality, and their feedheating and distilling apparatus is, perhaps, the most economical and efficient we know of. The propellers, which are of manganese bronze, have three blades, and are eight feet in diameter, with a mean pitch of nine feet, and a combined total area of 42 square feet.

In the telegraphic arrangements Messrs. Laird have introduced a novelty to ensure that the commanding officer shall know exactly how the engines are working. There is an eccentric keyed on the reversing shaft, which, through its rod, works a telegraph, by Chadburn & Sons, in which is a pointer. Thus the position of the links is seen at once. A similar telegraph, placed in the conning tower, enables the commanding officer to know in which direction the engines are moving. There is a very complete system of engine-room and steering telegraphs by Messrs. Chadburn & Sons. Among the former there is one which enables the engineer to indicate to the boiler-room the pressure of steam to be maintained. We believe that Mr. R. Bevis, jun., has taken a leading part in introducing these many valuable improvements. There are also electric bells, voice tubes, &c., throughout the ship. The ship is lit throughout by electrity, there being two sets of Parson's terbo motors, each driving direct a shunt-wound dynamo, by Latimer, Clark & Co., of London. In the conning-tower is a projector by a Parson's of 25,000 C.P. With regard to the habitability of the vessel the large forecastle and lower forecastle give abundant accommodation for the petty officers and crew. There is plenty of space, and the ventilation is very good. In the poop are the steward's pantry, the petty officers' ward-room, and the commander's quarters. The accommodation for officers is, considering the size of the vessel, very good indeed, and so far as health is concerned, the *Almirante Condell*, could keep the sea for an indefinite period without causing any undue discomfort to her crew. The accommodation for the captain in the after end is plain but very comfortable. Over the cheffonier, in the after end of the cabin, is placed a fine oil painting of Captain Prat, who was killed during a naval engagement at Iquique in 1879, and we understand a portrait of this officer is found in every vessel of the Chilian Navy.

The armament consists of torpedoes, Hotchkiss guns and Gatlings, whilst the stem may also with the ram be regarded as a formidable weapon of attack. The torpedo impulse tubes are five in number, and are mounted on the main deck, two on each side and one in the bow. The torpedoes, eight in number of the service size, 14 in. in diameter, by 14 ft. 6 in. long, were supplied from the Whitehead Factory at Fiume. Trials have been made to ensure that all the fittings in connection with these deadly weapons are in good working order. The method of ejecting the torpedoes is on the Canet system, the impulse tubes being supplied by the Forges et Chantiers, of Paris. The Hotchkiss guns are up to ten centimetres diameter on the sliding-wedge breechloading system. In the *Almirante Condell* the battery consists of three 14-pound Hotchkiss quick-firing guns, four 3-pound Hotchkiss quick-firing guns, and two Gatling machine guns. Of the 14-pounders, two are on the forecastle *en echelon*, another on the poop. Two 3-pounder guns are placed on the sponsons amidships and two on the poop. The Gatlings are placed in a most commanding position, namely, on the search-light platform above the conning tower, and at the break of the poop. There is thus a range of fire commanding the whole circle of the visible horizon. This can be directed as follows:—Dead ahead, two 14-pounders, four 3-pounders; dead astern, one 14-pounder, four 3-pounders; on the starboard broadside, three 14-pounders, and two 3-pounders; and on the port broadside two 14-pounders and two 3-pounders. The three-pounders are mounted on the well-known Hotchkiss non-recoil carriages. This is not so with the larger weapon, which is mounted on the recoil principle. All the carriages are fitted with shields of ⅜ inch tempered steel, for the protection of the guns' crews against the fire of the lighter machine guns. The three-pounder gun, with an elevation of eight degrees, has a range of 4,400 yards (2½ miles), at which distance it will readily perforate the sides of all torpedo boats and unarmoured cruisers. The 14-pounder guns have been fixed at angles of elevation up to 15 degrees, at which elevation the range is 7,200 yards, or rather over four miles. At 1,000 yards its steel shell pierces six inches of solid wrought iron, as determined by actual experiment. Up to the maximum fighting ranges, say 1,200 yards, it will not only perforate the sides of all torpedo boats and unarmoured cruisers, but the shields of all guns not actually protected by armour. The 14-pounder carriage is specially designed for the conditions obtaining on light vessels like the *Lynch* and *Condell*, where of necessity the decks are very light, and where little weight can be spared for locally strengthening them. The carriage consists of a cradle, pivot, and stand. The cradle is a single bronze casting, which is provided with a pair of steel hydraulic cylinders to the front and a pair of telescopic cylinders to the rear. Between these cylinders are a pair of slides, which receive the trunnion of the gun. The pistons of the hydraulic cylinders are secured to these slides, and by their resistance absorb the energy of recoil. The pistons of the hydraulic cylinders are provided with orifices, the area of which varies with the velocity of the recoil of the gun, and offer a constant resistance to this movement. The gun is brought to rest in a distance of 5·9 in. by a constant resistance of 16 tons. Heavy coiled springs in the telescopic cylinders immediately return the gun to its firing position, the movement of recoil and return to battery being performed in a small fraction of a second. The cradle is provided with trunnions, and is supported by a pivot, which latter rests in the socket of the stand. The shoulder-piece, by which the gun is pointed, is secured to the cradle, so that none of the shock of recoil is transmitted to the shoulder of the gunner. The trunnions of the cradle with the pivot form a universal joint, enabling the gun to be pointed in any direction by the gunner.

THE AMERICAN NAVY.—The United States Secretary of the Navy has just decided upon the orders for three additional battleships and a protected cruiser for the American Navy. Four firms competed, and the Secretary has notified Messrs. W. E. Cramp & Sons, Philadelphia, of the award to them of the contract for the construction of two coast-line battleships for 3,020,000 dols. each, and the contract for the triple-screw protected cruiser at 2,725,000 dols. The Union Iron Works, San Francisco, have also been informed of the award to them of the contract for the construction of one of the battleships at 3,180,000 dols., the amount of the Cramp tender for one vessel. Their tender was 3,240,000 dols., and the award is consequently 60,000 dols. less. Should they decline to accept this figure then the contract for the four vessels will go to the Cramps. The contract given to the Philadelphia firm is the largest ever given to a single yard in the United States, the amount aggregating 8,765,000 dols. The vessels are to be afloat by 1893. When finished the United States will possess a modern navy consisting of 15 armoured vessels, five of which will be of the battleship type, and 31 unarmoured steel vessels—total, 46 first-class ships of the latest construction, material, and armament.

THE KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING STATIONS.

ON the 4th of October last, on the invitation of Mr. Crompton of Messrs. Crompton & Co., Limited, the members of the Institute of Marine Engineers paid a visit to the Kensington Station of the Kensington and Knightsbridge Electric Lighting Co. There were present:—Messrs. James Adamson, W. Blakey, J. A. Bisset, W. J. N. Brett (associate), T. Campbell, J. Gale, J. McF. Gray, J. G. Hawthorn, J. Milne, J. Newby, C. Noble, J. Phillips, J. R. Ruthven, F. W. Shorey, M. C. Storrar, J. Simpson, J. W. Simpson, J. B. Small, J. H. Thomson, J. Thomson, D. Urquhart, W. W. Wilson, &c.

The visitors were received, in the absence of Mr. Crompton, who was then in Copenhagen, by two of his assistants and conducted by them over the works. On the ground floor are placed the engines and dynamos as well as the boilers, those latter made by the Babcocks & Wilcox Co., and meters showing the current to the charging batteries and that to the public for consumption. Here also is the switch-board erected on a raised platform and furnished with all the very latest improvements. On the floor above is the cell room, where a large number of these are fixed. Each cell has 16 plates, and the aggregate storage would, in the event of a breakdown of the engines, furnish current to the whole system for a sufficient length of time to enable other machinery to be got into working order.

THE CROMPTON DYNAMO.

This company commenced working in 1887 and has been working continuously ever since. The original central station situated at Kensington Court has now been fitted with machinery so that it is sufficient to supply 30,000 lamps attached to the system. A second station at Chapel Place, Knightsbridge, has been constructed, which is able to supply 20,000 lamps. At present about 19,000 lamps are attached to the two stations. The company has practically completed laying its mains throughout all the principal streets in the district, which extends from Kensington High Street on the west to Albert Gate on the east; from Hyde Park and Kensington Gardens on the north, to the main line of the Metropolitan Railway on the south. Altogether upwards of ten miles of mains have been laid. These mains are all under ground, and are laid in concrete culverts made in the footways, having openings with removable covers opposite every second house. The conductors are of bare copper stretched over insulators of glass, and the house connections can be made to the above-mentioned openings without the necessity of ever again disturbing the surface of the street. The company's engineers consider that the whole of the public inconvenience due to reopening of the streets is thus avoided.

The system employed is the low-pressure continuous current system, in which accumulators are employed as reserve of power and as a means of keeping the supply of current absolutely constant, and avoiding the possibility of breakdown of the light. The company, we understand, boasts that during the close on four years it has been in operation, that it has not had one complete failure of the lights. The inhabitants in whose houses the 19,000 lights are fixed, testify to the extreme steadiness and trustworthiness of the light.

The whole of the electricity is sold by meter, and the customers have in all cases been satisfied with the system of measurement, which has led to no disputes. In very many cases, indeed, surprise has been expressed that the cost of the lighting has been so low, and has compared so favourably with the modes of illumination previously employed.

The whole of the designs of the machinery and arrangements of the stations have been carried out by Mr. Crompton and his staff of assistants, while the credit of the large clientele already obtained is largely due to Mr. Erskine, the energetic secretary of the company.

A very important feature of the system used by this company is that it is absolutely safe and certain in working. There can be no fear of extinction of the lights, and past experience has gone to show that these claims will be fully realised. Although the engine and accumulator power that is now fitted in the two stations is considered sufficient to meet the demand that is likely to occur during the ensuing winter, yet the two stations can be equipped for the full capacity of 100,000 lights at a very short notice.

It may be remarked that the Kensington and Knightsbridge station was the pioneer of the low-pressure system in this country, and that there are already stations being erected on the same principle, by Messrs. Crompton & Co., at Notting Hill, Westminster, Birmingham, Southampton and elsewhere.

The members of the Institute were one and all greatly interested in examining the works and hearing the explanations offered by the courteous guides, and on leaving, on the motion of Mr. J. McFarlane Gray, seconded by the secretary to the Institute, Mr. Adamson, a cordial vote of thanks was awarded to these gentlemen for their kindness in receiving and accompanying the members through the works. Our illustration gives a view of one of Messrs. Crompton & Co.'s dynamos as used at all the stations fitted by them.

HOLZAPFEL'S COMPOSITIONS CO., LTD.

THE products of the Holzapfel's Composition Co. are so well-known among shipping circles in all parts of the world, that we have no doubt the following particulars respecting the development of the firm's business in later years will be acceptable to our readers. For a number of years the manufacture of the firm's specialities has been carried on in the South Shore Road, Gateshead, the premises in which the work was done being from time to time extended to meet the steadily increasing requirements of the business. About a year ago the firm leased a large building situated contiguously to their works, and having had it altered to suit the purposes of their trade, are now utilising it in a further important extension of manufacturing operations. The ground-floor of this building is occupied mainly with manufacturing plant, such as mixing vats, grinding mills, &c., the second-floor being devoted principally to the storage of goods, while on the third floor part of the space is similarly used; accommodation being also provided for a number of operatives engaged in making neatly-fashioned sample cases. On this floor there is also a specially-constructed store-room for varnish, into which not a particle of dust can penetrate. The building has an extensive river frontage, and should it be necessary, deliveries of goods can be made direct to craft coming alongside. On leaving this building and crossing the South Shore Road, we enter the older section of the works, where the earlier and more important stages of the manufacture are carried on. Here we have again brought under our notice a long row of mixing vats and a number of other necessary adjuncts used in the making of the compositions. The process of making varnishes is carried on in a special and fireproof building; and in connection with this department it may be mentioned that an arrangement has been introduced which constitutes a very interesting feature. By this arrangement the whole of the vapours that are emitted by the melting down of gums, are caught and distilled, and the danger of the varnish pots taking fire through the vapours being thrown back is avoided. A valuable oil is also caught, and the disagreeable odour which is usually associated with the operations of a varnish kitchen, is entirely prevented. One of the d[illegible]ishing characteristics of Messrs. Holzapfel's enterprise [illegible] try to supply from their own resources as many as possible of their own mechanical requirements. They, accordingly, not only make the compositions and most of the raw materials required in the manufacture, but they also make the casks and sheet-iron "drums" in which the products are consigned to the agents and customers. Two sets of men—coopers and drummakers—are constantly employed in the manufacture of these articles, and judging by the daily increasing demand for the firm's specialities, this is a department of the business which will very soon require extension. Up to the present the "International Antifouling Composition" has been the speciality most largely manufactured by Messrs. Holzapfel, and practical men will be able to form an approximate estimate of the output when informed that in this country over 100 vessels—most of them of large size—are coated monthly, and quite as large a quantity is exported as is required for home consumption. Of the special excellence of this article as a preservative against fouling nothing needs here to be said—the large consumption indicated by the foregoing statement is indeed a sufficient testimony to its merits. Some time since Messrs. Holzapfel put on the market their patent "Soapstone Composition," a paint which is specially designed for the protection of iron and steel surfaces against atmospheric influences, and the large sale it has already attained shows how highly it is appreciated.

Among the principal users of the firm's compositions are the Indian Marine, the Crown agents for the Colonies, and several Governments, including our own Admiralty, the very strongest proof being thus afforded of the high esteem in which the products are held. The firm have recently been appointed agents and manufacturers for the North of England and Scotland in connection with a speciality known as the "Light Asphaltic" marine cement, the chief constituent parts of which being ground corkwood and asphaltum, it is understood to possess in an unequalled degree the qualities most essential in a cement for ships' bottoms. Its specific gravity being from 50 to 75 per cent. less than that of any other marine cement, it is estimated that 12 tons of this material will be sufficient for a vessel of 4,000 tons burden. This involves an important saving of cargo space, the quantity of Portland cement required for a ship of the same tonnage being about 85 tons. There cannot be a doubt that a large business will be done by the firm in this article, and that it will ultimately become as closely associated with their name as the other specialities for which they are so well and widely known.

TRIAL TRIP OF S.S. "BOSTON."

ON Monday, October 21st, this magnificent steel screw steamer, built by Messrs. Alex. Stephen & Sons, Linthouse, for the Yarmouth Steamship Co., of Yarmouth, Nova Scotia, completed a series of official trial trips. The *Boston* is a steamer of the following dimensions:—Length, between perpendiculars, 245 ft.; breadth, 36 ft.; depth to hurricane deck, 28 ft. 9 in. She has been constructed for the passenger trade between Yarmouth, N.S., and Boston, and has sleeping accommodation of a most superior description for about 300 first-class passengers, partly under the awning deck, and partly in the superstructure above the awning deck, which is formed by the side plating being carried up to the hurricane deck, and extends the full length of the vessel. The dining saloon and principal state rooms are located in this superstructure. The dining saloon, which extends the full width of the steamer, is a splendidly finished apartment, the design of the sides being marked by shaped and carved pilasters, with panels between, in which are windows and octagonal bevelled mirrors. In the fore end are oval-shaped mirrors alternating with octagonal ones. The woodwork is of finely selected birch, satinwood, and plane-tree. At the after end are two sideboards, in which are carved panels and figure designs in Mr. W. Scott Morton's Tynecastle canvas. The frieze and ceiling enrichments are in the Tynecastle canvas, of a soft cream colour, enriched with soft light olive and gilding. The companion way or grand entrance is of toned oak framing and rich Chippendale mahogany panellings. The saloon is seated to dine 62 passengers, with sofas on each side of the vessel, and revolving chairs, all richly upholstered in olive coloured Utrecht velvet. The pantry adjoins the fore end of the saloon, and is fitted with every convenience for the ready supply of all wants to the passengers, while the culinary arrangements are extensive and complete in every way. The social hall is situated aft on the awning deck, in the centre of vessel, and is in panelled work of clear finely-stained mahogany graining, with panels of selected mellow plane-tree, and each section of the design is separated by a fluted pilaster rising from the base to the cornice. The effect of this compartment is refined and cheerful. The state rooms have been furnished with woven wire mattresses, and folding lavatories in walnut of a special design, while the floors are covered with Axminster rugs. On the hurricane deck there are two large deck-houses; the after contains ladies' cabin, handsomely furnished and finished, ticket office and clerks' room, and entrance to the social hall by a handsome stairway. The forward house, in addition to the grand entrance to dining saloon, also contains smoking-room upholstered in morocco, and state rooms for principal officers; while the fore part forms pilot-house in American fashion, with captain's apartment immediately adjoining, having communication with wheelhouse and bridge. Superior accommodation has been provided on main deck for engineers, stewards, &c., alongside engine casing; sailors and firemen having comfortable apartments forward on awning deck. Throughout the whole of the accommodation great care has been taken to secure ample light and thorough ventilation, while the vessel is heated by steam throughout. The *Boston* is fore and aft schooner-rigged, and is fitted with every appliance for the efficient handling of the vessel, including steam and hand steering gear, steam windlass with capstan on hurricane deck, and steam warping capstan aft. She has two funnels, and has a very smart appearance in the water. The vessel is propelled by a set of Messrs. Stephens' most improved triple-expansion engines, having cylinders 34 in., 51 in., and 84 in. diameter, by 36 in. stroke, which are supplied by steam of 160 lbs. pressure (under natural draught conditions only) from three large steel boilers having fifteen of Purves' patent ribbed flues. All the fittings of engine-room and stoke-hole are of the most complete description, and include Weir's patent automatic feed pumps, Drysdale & Co.'s centrifugal circulating pumps, separate bilge and ballast pumping engines, and Galloway's patent steam ash hoists and tipping apparatus. She has been painted with Hartman's Rahtjen's composition. The vessel is fitted throughout with electric light. On six consecutive runs on the measured mile at Skelmorlie, with full 250 tons deadweight on board, she attained a speed ranging from 18·09 to 18·32, and averaging 18·22 knots, or about 1¼ knots above the guarantee. This speed it is believed marks the *Boston* as the fastest single-screw passenger steamer of her dimensions in the world. The general plans of the steamer were arranged personally with Hon. L. E. Baker, the president of the Yarmouth Steamship Co., and the construction has throughout been superintended by Captain Harvey Doane, one of the leading members of the company, and a steamboat captain of great experience.

NEW STEAMER ON THE CASTLE LINE.

MESSRS. DONALD CURRIE & Co. entertained on October 3rd a large company at luncheon on the new Cape Royal Mail steamer, the *Dunottar Castle*. The new steamer, which is now the largest ship of the fleet, being upwards of 1,000 tons more than the *Roslin Castle*, has been built for the Castle Mail Packets Co., Limited, by the Fairfield Shipbuilding and Engineering Co., of Glasgow. Her registered tonnage is 5,465 tons; length, 435 ft. (over all); breadth, 50 ft.; depth, 36 ft. She is built entirely of steel, with a continuous cellular double bottom, and has eight vertical watertight bulkheads, which extend to the upper deck and divide the vessel into nine compartments, thus minimizing risk in case of accident. Special attention has been given to the accommodation for passengers, the ventilation, lighting, and sanitary arrangements being of the most improved and modern character. She has lofty 'tween decks, with commodious reception and sleeping apartments replete with every convenience and luxury, while her first-class passengers' promenade deck extends about two-thirds of the vessel's length. The first-class dining saloon, which stretches across the full width of the ship, is pannelled in dark mahogany, relieved with satinwood. The ceiling is painted ivory white, and is divided into panels, which are enriched with a delicately-tinted ornament, Italian in feeling, the prevailing colours used being yellow and gold, relieved here and there by touches of pale red and blue. The music room, on the upper deck and above the saloon, is panelled with different shades of satinwood. The ladies' boudoir, situated next to the music saloon, is panelled in satinwood, and, like the music room, has a richly-decorated ceiling. The covering of the furniture is of a very delicate and artistic material. The second-class saloon, which is forward, will seat 100 passengers. It is handsomely fitted up, contains a library and a piano, and is furnished with revolving chairs. All the decorations have been designed by Mr. J. M. Maclaren, architect. The steamer is lighted throughout by electricity, the installation being the work of Messrs. Siemens Bros. & Co., of London. The engines are of 7,000 H.P., and are of the triple-expansion type, with the high-pressure cylinder 38 in. diameter, the medium-pressure cylinder 61½ in. diameter, and the low-pressure cylinder, 100 in. diameter, the length of the stroke being 5 ft. 6 in. Steam is supplied at 160 lbs. pressure by four large boilers with Fox's corrugated furnaces. The boilers have been constructed of steel, under the superintendence of the Board of Trade and Lloyd's surveyors. The trial trip of the *Dunottar Castle* took place on August 28th, when very satisfactory results were obtained, the average speed recorded being 17 knots.

GALLON & CHAPMAN'S PATENT HYDRAULIC CAPSTAN.

AMONGST the principal novelties in machinery at the Edinburgh Exhibition is one of the exhibits of Messrs. Hawthorns & Co., shipbuilders, marine and general engineers, Leith—viz., Gallon & Chapman's Patent Hydraulic Capstan.

Although, hitherto, this capstan has been adopted only in connection with docks, it is equally adaptable for use on sea-going vessels, and will no doubt be very extensively used, when better known, as in its design and construction simplicity and efficiency have been secured.

In our illustrations figs. 1, 2 and 3, we show Gallon & Chapman's Patent Hydraulic Capstan, as fitted at the Albert Dock, Leith, where one of these capstans has been in use two years, and a second has been fitted up during the present year, owing to the satisfactory and economical working of the first one.

Fig. 1 shows an elevation view, fig. 2 a plan of Gallon & Chapman's Patent Hydraulic Capstan, and fig. 3 is a detailed view of the slide-valve link.

The capstan (B) is actuated by two double-acting oscillating cylinders (C C) of which the piston-rods (E E) are attached direct to the single-crank D, an arrangement resulting in high effective power. The cylinders are lined with brass, and oscillate a very few degrees of a circle, on two long bearing pins L (see fig. 1), which pass through bosses on the bedplate, carrying the oscillating block H. The pistons (F F) are fitted with first-class Manilla rings, (one packing lasting for years) which is both more economical in first cost and wear and tear, as compared with leather. The slide valves, P P, and faces are of extra hard gun-metal to insure longevity, and the slides are governed by a single or double link (see fig. 3) and cannot get off their faces or out of place. The starting is effected by side valves, being controlled by a lever (A) easily worked by the foot of the operator, and an adjustment is provided for regulating the speed of the capstan. The crank-pin is long, and, as well as the crank-shaft, is fitted with a gun-metal bearing. The piping arrangements are also very efficient, and are shown in our illustrations, the main pressure supply pipes (R R) and exhaust pipe (K) oscillating slightly, being fitted with stuffing-boxes and glands, provided with packing capable of lasting about two years.

It will be seen that there is ample space for packing the glands and oiling, and that there are few working parts, all of which are simple in design, and either

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first-class castings or forgings. In Gallon & Chapman's Patent Hydraulic Capstans there are no complications, and owing to their simplicity of construction they can be maintained in working order with the *minimum* of attention, repairs being very rarely necessitated, as spur wheels, cupped leathers, rubber rings, circular valves, and friction rollers are entirely dispensed with. Largely the success in designing these patent hydraulic capstans is due to the lengthened experience—over thirty years—the patentees and makers have had in the making and repairing of hydraulic capstans. The fullest inquiry is courted, and interested parties can at any time see these capstans at work at the Albert Dock, Leith.

They can be made to meet special requirements of any kind, to pull loads of one ton and upwards. Worn-out or inefficient capstans of other makes can be readily adapted, so as to secure all the advantages of Gallon & Chapman's improvements at a moderate cost, and any information relating to them can be obtained on application to Messrs. Hawthorns & Co., engineers, Leith, or of Mr. T. Gallon, Leith Docks, N.B.

SHIPBUILDING AT STETTIN.

OF shipbuilding ports on the Continent, Stettin, in Germany, is the one that competes most with British builders in respect of high-speed vessels, exclusive of course of French yards, which build only for French firms, who seldom invite British constructors to tender for work. The British Consul at Stettin has given, in a report lately issued, one or two facts about shipbuilding which are worth noting. There are three yards, the most important being the Vulcan Works, from which there were last year delivered seven steamers, including the Hamburg-American liner *Augusta Victoria*, of 7,661 tons gross, with triple engines of 12,500 I.H.P., which quite recently completed the voyage from Southampton to New York in 6 days 22 minutes 54 seconds, a good performance; and the *Kaiser Wilhelm II.*, of 6,990 register tons and with engines of 7,000 I.H.P. Other two steamers were 4,375 tons register and 3,300 I.H.P., and the remainder ranged from 1,251 to 395 tons. At present the firm have orders for execution representing £1,629,630, including one twin-screw steamer of 9,000 tons and 14,000 I.H.P., two of 7,000 tons and 11,500 I.H.P., two Imperial German Navy corvettes 10,000 tons displacement and 8,000 I.H.P., and other smaller craft. The company do not confine themselves to shipbuilding. Last year they delivered a large marine engine with boilers, nine different steam engines, five marine boilers, two stationary boilers, and 59 locomotives. They had orders at the beginning of the year for 87 locomotives. There were employed in the works on an average last year 4,014 men against 2,611 in 1888, the lowest number last year being 3,504. For labour they paid £190,254. Their dividend was 5 per cent. They consumed 3,273 tons pig-iron, 1,977 tons bar-iron, 1,037 tons section-iron, 2,039 tons iron plates, 9,020 tons steel plates, and 4,152 tons angle and bulb steel, with 1,683 tons other steel; 24,907 tons coal and 4,010 tons coke. There are in the works 58 steam engines of a collective H.P. of 1,500, and 16 steam hammers of together 241 cwt. In their iron floating dock they have berthed in the year 77 vessels. Messrs. Möller & Holberg, also shipbuilders, delivered last year 38 river steamers, of a total register tonnage of 1,640, and 3,810 I.H.P., four steam lighters, of 675 register tons, and three steam dredges of 92 I.H.P. They have building 24 steamers, of 2,540 register tons and of 3,090 I.H.P. A third firm constructed a paddle steamer of 601 tons and 1,000 indicated H.P. It may be added that the shipping trade of Germany is reported as active, with fairly good freight rates.

MESSRS. JOHN BROWN & CO., Limited, of the Atlas Iron and Steel Works, Sheffield, have just received an order from the Dutch Government to supply 1,000 tons of "Ellis" compound armour for the armament of two new battle-ships about to be built by contract at Amsterdam.

THE PROSPECTS FOR ENGINEERS IN THE FAR EAST.

AT one time China and Japan were well-known to afford engineers better chances in the way of emolument than they do to-day. There was an uncertainty with regard to employment in this out-of-the-way part of the world that does not obtain so much now. The owners of steamships there were not to be found in our own ports, and rightly no doubt, claims were higher accordingly. Length of time, however, has sufficed to prove that engagements may be as safe, if they are properly authenticated, in the East as in the West, and that service with Oriental ships is not of that uncertain nature it was supposed to be in the earlier days. As information became more diffused the inevitable results have gradually followed, and there has been a decline in the rates of pay, till wages on an average are not much different to what they are in nearer waters. This state of things is very much to be regretted, but we are afraid they were inevitable sooner or later. Recently, there was some talk of combination to prevent a further drop. The movement did not come to a head, however, and we think there are very good reasons for its failure.

Twenty years ago, when attention was prominently directed to these countries, engineers were in great demand by local companies. They had only to ask and an agreement was fixed. As trade became developed and education extended with the smaller power, the natives themselves blossomed forth as engineers. The idea was at first scouted that Europeans could ever be dispensed with in these important duties, but it is now a matter of common knowledge that our Japanese friends are well able to hold their own in superintending the building of engines and in managing them afterwards. We do not say the work is carried out as efficiently, but it is important to remember that it is done at much less cost. In the leading steamships and other smaller lines, a slow process of extinction is going on in favour of native labour, and we are afraid this is likely to be increasingly continued. The cry is Japan for the Japanese, and until some further political change takes place, this means that the country's steamers have the monopoly of the carrying trade. While this is the case it is easily understood that a European has no chance at about double expense, which his more costly living necessarily entails.

If we turn to China a different condition of things is found. There is no native competition worth mentioning, and the comparison in fourth engineer's pay is about four to three, that is, 80 dols. a month for China against 60 or 65 dols. for Japan. Even the former is much less than the rates ruling in past times. What then has caused any falling off with respect to the larger country? Simply, we answer, the stagnation inherent to all Chinese institutions. There is no movement of a progressive character to warrant further employment. The good time that has been said to be coming on so many occasions, when modern appliances were to be snapped up, and trade correspondingly be promoted, has not yet put in an appearance. Meanwhile other nations have had time to look round them, and German steamers are not unknown on the China coast now. As a sequence we find their engineers ready to do what our own will, and at lower figures. With such main influences as we have quoted at work, it can be well comprehended that marine engineers have a widely-altered state of affairs to contend with in the far East to-day to what they had when modern ideas first took any shape at all. What then, it may be asked, is to be the end of the downward movement that has set in? We reply that it can be no other than a more complete equalisation still as time advances. Even the advantages that now obtain will be swept away, and this *terra incognita* become on the same footing as elsewhere, as far as marine engineers are concerned. When the technical knowledge necessary for these positions has thoroughly lost its novelty, as it will surely do with the rapid communication of the present day, then employers will no longer have to seek for aid in the management of their engines, but it will be ready at their own doors. This consummation, though not yet to hand, is fast approaching, and it behoves those who are interested to prepare for it.

MESSRS. SCOTT & CO., shipbuilders, Greenock, have secured a contract to build three steel screw steamers of about 2,000 tons each, for Messrs. John Swire & Sons, London. The steamers are intended for Eastern trade, and will be supplied by the builders with powerful engines of the most approved type.

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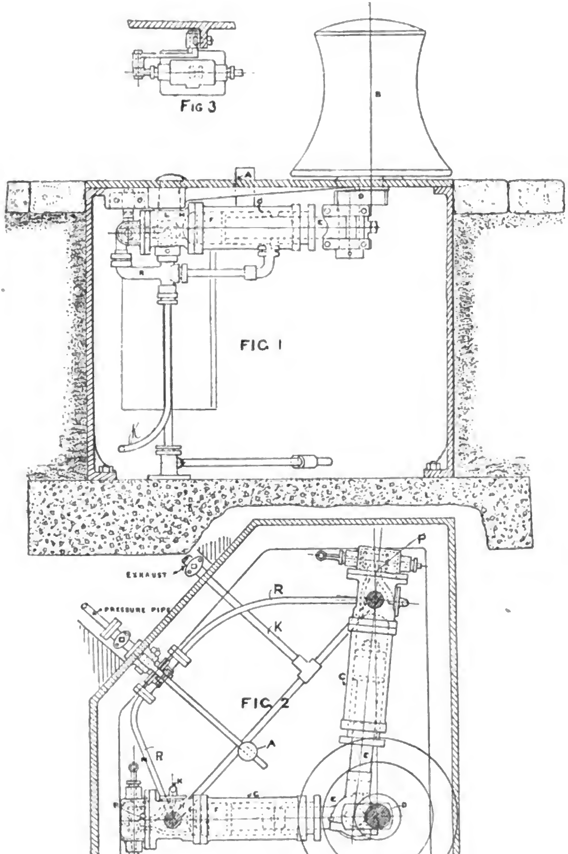


Gallon & Chapman's Patent Hydraulic Capstan—*see page* 337.

HAMILTON'S PATENT STEAM STEERING GEAR.

We here illustrate a new form of steam steering gear, which embodies some novel features. Fig. 1 is an illustration, from a photograph, of the exterior of this gear, showing combined hand and steam gear; while figs. 2 and 3, taken from the patent specifications—and, therefore, not just perfect in detail matters of construction—show the principle of its action. Fig. 2 is a section through the cylinders and valve chest. The valve A is of the rotary type, similar in outline to an ordinary piston valve, but having ports cut in its circumference. The ports S S communicate through the body of the valve with the annular spaces B B′, while those marked E communicate with the spaces C C′ at the ends of the casing. Now it is obvious that if A be rotated, the ports E S E S passing a port in the casing leading to one of the cylinders will place that cylinder in communication with B B′ and C C′ alternately; so that if B B′ give the steam supply and C C′ the exhaust, the engines will revolve in one direction; and if *vice versâ*, then in the opposite direction. This change from steam to exhaust in B B′ and C C′ is effected by the controlling valve F, shown in enlarged section at fig. 3. The valve is hollow and slides on a feather on the spindle, I, which is turned by the steering wheel. Steam from the boiler is admitted by a pipe, not shown, to the casing at H, the other end H′ being also supplied through the body of the valve. The port G connects the annular spaces D D′ with the exhaust pipe. On the waist of the controlling valve F a worm is cut, gearing with a worm wheel on the waist of the valve A, the two valves being at right angles to each other. Now supposing the steering wheel and the spindle, I, to be turned to the right, the valve F, in revolving, will be constrained to move on end in the direction of H′ since the worm wheel A will act as a stationary nut. The end movement opens the ports J J′ and admits steam from H to the annular spaces B B′ of the distributing valve, thence to the cylinders through such of the ports S S as may be open to them, thus causing the engines to revolve. The valve A also rotates, but in so doing the worm wheel on its waist, gearing into the worm F, acts as a pinion and rack and slides back the controlling valve into its original position, closing the ports J J′ and stopping the engines. In the same way when I is turned to the left hand, steam is admitted by the ports K K′ to the ends of the casing at C C′, driving the engines in the opposite direction, the motion of the engines bringing back the controlling valve to its original position as before. The annular spaces D D′ in the controlling valve connect, as may be seen, the ports J J′ with the exhaust when the valve moves towards H, and the ports K K′ when it moves towards H′.

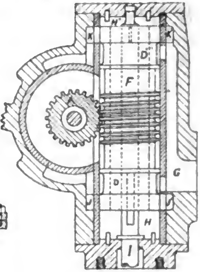


Fig. 3.

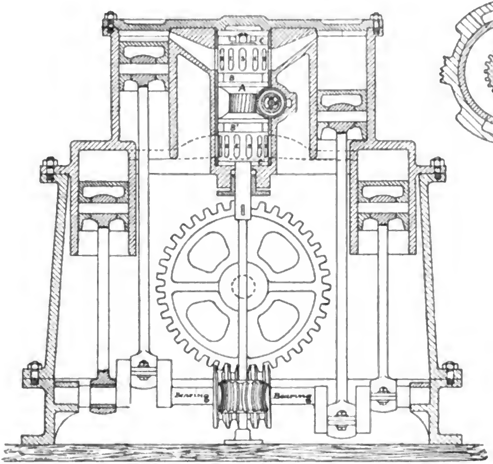


Fig. 2.

By the employment of single-acting engines some advantages are gained as the gear will work for a whole voyage with little or no attention, there being only two stuffing-boxes, viz., those of the distributing and controlling valve spindles. The working parts are all cased in and protected from dirt or damage from loose articles tumbling about in rough weather. Where, as is sometimes desirable in long voyages, the exhaust from the steering gear is coupled to the condenser of the main engines, some of the neatness of appearance and compactness must be sacrificed, and two double-acting cylinders substituted for the four single-acting. However there still remains the freedom from eccentrics, clutches, cams or levers, which is one of the most notable advantages possessed by this steering gear. The makers are Messrs. Marshall, Fleming & Jack, Dellburn Engineering Works, Motherwell.

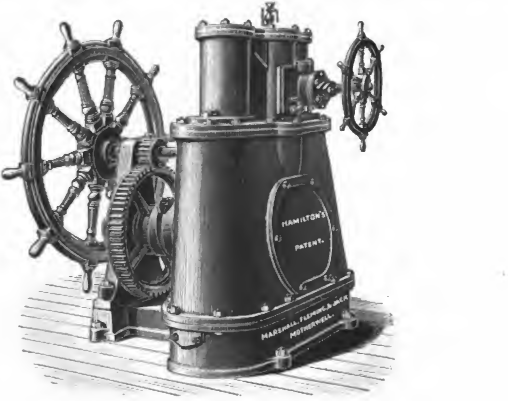


Fig. 1

THE NORDDEUTSCHER LLOYD STEAMER "SPREE."

THE latest addition to the fleet of steamers on the Southampton and New York line is the *Spree*, a vessel of 9,000 tons register, built at Stettin by the Vulcan Co. for the Norddeutscher Lloyd. In nautical circles her performances on the approaching first voyage across the Atlantic are looked forward to with much interest. Although all the latest improvements have been fully availed of in her construction, her designers, evidently lacking sufficient faith yet in the twin-screw, have adhered to the one-screw system, which, it must be admitted, has, in the latest of the nine express steamers built by the Fairfield Co. for the Norddeutscher Lloyd, and especially in the case of the renowned Cunard liners *Umbria* and *Etruria* by the same builders, reached the point of perfection. It is a remarkable fact that these two most powerful companies on the North Atlantic have not yet adopted the twin-screw, which has already achieved such wonderful results for their competitors. The *Spree* is the first steamer specially built for the New York line of her owners at a German yard. She is 485 ft. long, 52 ft. beam, and 38 ft. deep, moulded, and has accommodation for 244 passengers in the first saloon, 122 in the second saloon, 460 third-class passengers, and officers and crew to the number of 240. The vessel is rigged with three pole masts of steel, without yards. The engines are triple-expansion; the high-pressure cylinder is 38 in. diameter, the intermediate pressure 75, and the low-pressure 100, each of which is adapted for a strike of 6 ft. Steam is supplied from ten boilers, of which six are double-ended and four single-ended. Each boiler is 15½ ft. in diameter; the length of the double-ended is 18 ft. 8 in., and of the single-ended 10 ft. 4 in. The boilers are constructed entirely of steel and are adapted for a working pressure of 11 atmospheres. The propeller has four blades of manganese bronze, the diameter of the screw being 21 ft. 7 in., and its pitch 31 ft. 4 in. The requirements of the German Government being rather in excess of those of the Board of Trade, the builders were compelled to use the greatest care in the construction of hull and boilers. On her trial trip in the Baltic the *Spree*, although not worked up to her full capabilities, showed a mean speed of 19·6 knots. The highest speed obtained was 20·1 knots, the engines developing 13,000 H.P. and making 70 revolutions. The vessel is lit throughout by the electric light, and her cabin accommodation is most comfortable. She has a fine promenade deck, the spaces on each side usually occupied by the boats swung on the davits being kept clear of all obstruction, the boats and the ventilating apparatus being placed on the permanent wooden awning over the promenade deck. The *Spree* is commanded by Captain Willigerod, Chevalier of the Prussian Crown Order, and leaves Southampton on her first voyage to New York. Her sister ship, the *Havel*, now building at Stettin, will be placed on the line early next year.

ENGINEERING STAFF.—With a view of promoting engine design and construction in the dockyards, the Admiralty have decided to increase the engineering staff of each of the three principal yards by the appointment of a specially qualified engineering officer as head of the several drawing offices. Mr. Philip Maruck will go to Devonport, Mr. Frederick A. Hobbs to Portsmouth, and Mr. George G. Godwin to Chatham. These officers have all passed through the special course of training at the Royal School of Naval Architecture, and at the Royal Naval College at Greenwich.

THE MERCHANTMEN OF THE PRINCIPAL SEAFARING NATIONS.

THE world's statistics for the year 1890-91 concerning the respective strengths of the merchant navies of all nations contains many interesting facts, and proves more than anything else to what enormous degree English commerce overshadows the rest of the world. Of the 33,876 sailing vessels with an aggregate net tonnage of 10,540,051 tons—

10,559	ships of	together	3,693,650	tons	were	English,
3,406	,,	,,	1,445,016	,,	,,	American,
3,567	,,	,,	1,405,934	,,	,,	Norwegian,
1,698	,,	,,	706,475	,,	,,	German,
2,402	,,	,,	655,640	,,	,,	Italian,
2,131	,,	,,	455,907	,,	,,	Russian,
1,799	,,	,,	373,397	,,	,,	Swedish,
1,457	,,	,,	299,473	,,	,,	Greek,
1,627	,,	,,	298,787	,,	,,	French,
1,359	,,	,,	253,426	,,	,,	Spanish,
861	,,	,,	230,250	,,	,,	Dutch,
877	,,	,,	145,862	,,	,,	Danish,
330	,,	,,	120,729	,,	,,	Austrian,
512	,,	,,	89,357	,,	,,	Turkish,
146	,,	,,	74,587	,,	,,	Chilian,
320	,,	,,	68,266	,,	,,	Portuguese,
268	,,	,,	56,222	,,	,,	Brazilian,
104	,,	,,	20,378	,,	,,	Argentine,
104	,,	,,	27,721	,,	,,	Japanese.

And of the 9,638 steamers of more than 100 tons net each, and an aggregate tonnage of gross 12,825,725 and 8,286,747 net—

				TONS GROSS		TONS NET
England	owned	5,302	steamboats of	8,043,872	and	5,106,581
Germany	,,	689	,,	930,754	,,	656,182
France	,,	471	,,	805,983	,,	484,990
America	,,	419	,,	533,333	,,	375,950
Spain	,,	350	,,	423,627	,,	273,819
Italy	,,	200	,,	294,705	,,	185,796
Norway	,,	371	,,	245,052	,,	176,419
Holland	,,	164	,,	220,014	,,	149,355
Russia	,,	230	,,	177,752	,,	116,742
Sweden	,,	403	,,	172,013	,,	126,642
Denmark	,,	197	,,	154,497	,,	103,578
Austria	,,	111	,,	149,447	,,	96,503
Japan	,,	147	,,	123,279	,,	76,412
Belgium	,,	55	,,	98,056	,,	71,658
Brazil	,,	129	,,	75,970	,,	48,901
Greece	,,	68	,,	70,435	,,	44,424
Portugal	,,	41	,,	49,364	,,	29,564

England has consequently afloat 31 per cent. of all sailing vessels, with 35 per cent. of the aggregate tonnage, and 55 per cent. of all steamers, with nearly 62 per cent. of the net tonnage. Calculating the net steamboat tonnage as equal to three times that of sailing vessels, the world's tonnage expressed for sailing vessels would be 35,400,292, and England's share 19,013,393 tons net, or 54 per cent., that is to say, 8 per cent. in excess of the capacity of the merchantmen of all other nations put together. This supremacy is due to a variety of causes, including the daring love of enterprise of the Anglo-Saxon race, the insular position of Great Britain, and the accumulated wealth of her people, whereas, a good deal of credit may also be given to the Board of Trade, a department in every way superior and more capable than, for example, the French "direction of the commercial navy," and similar red-tape institutions abroad. Turning to other countries the position occupied by Germany is evidence of the remarkable development of her external commerce, and considering the natural advantages enjoyed by France over her powerful neighbour it is rather surprising that her steamers represent both in numbers and tonnage only about two-thirds of the German steamboats. The United States are also singularly backward in respect of the importance of their merchant fleet, but there are now signs of increased shipbuilding under Government protection, which, if followed up, may soon place America in the first place after England. The latter need, however, entertain no apprehensions of being superseded in the ocean carrying trade, as her most energetic competitor Germany owns after all scarcely more than one-eighth part of the net English tonnage.

MESSRS. HANNA, DONALD & WILSON, Paisley, have contracted to build a passenger steamer of 190 tons for colonial owners. The vessel will be fitted with engines 320 H.P.

ELECTRIC LIGHT INSTALLATION.

THE electric light installation for the new offices of the *Bolton Evening News* has just been completed by Messrs. Ernest Scott & Co., Close Works, Newcastle-on-Tyne, electrical and general engineers.

The installation is one of the most complete if not the most complete in Lancashire, and lights the entire premises, the arrangement of lamps are as follows:—Basement, 46 lamps of 16 c.p.; ground floor, 58 of 16 c.p.; first floor, 127 of 16 c.p.; offices, 45 of 16 c p.; entrance, 1 of 200 c.p.; manager's office, 1 of 100 c.p.

The whole of the lights throughout the building, with the exception of the offices, are pendants, and each lamp is fitted with a switch secured to the pendant, so that every lamp in the installation can be switched on or off in the same way as gas.

There are two dynamos to drive the installation of Messrs. Ernest Scott & Co.'s standard "Tyne" type. Each machine is constructed to give an output of from 90 to 100 amperes at an electromotive force of 105 volts, the speed of each machine being 900 revolutions per minute.

As gas-engines are used as the motive power for driving this installation, each dynamo has been fitted with a very heavy turned fly-wheel supported on an outer bearing, and it has been found that the lights are perfectly steady, which is a result not very often obtained with gas-engines, unless special precautions are taken.

The current from these dynamos is taken to a main switchboard of a very handsome and massive description. The switchboard consists of an enamelled slate slab about 5 ft. long by 4 ft. wide, and is fitted with two of Messrs. Ernest Scott & Co.'s improved coupling switches for connecting the two dynamos in parallel. Four double main switches with fusible cut outs on both positive and negative poles are also mounted on the main switchboard. These switches are used to control the four departments, *i.e.*, basement, ground floor, first floor and offices.

Measuring instruments are also mounted upon the main switchboard, and by simply pressing the key the pressure and quantity of current can be instantly measured. The enamelled slate base is mounted in a deep oak frame.

The office fittings are extremely handsome, and consist of five polished brass pedestals for the counters, eight polished brass brackets for the desks, one pendant with cut glass globe for the main entrance containing a 200 c.p. lamp, and a pendant containing one 100 c.p. lamp for the manager's office.

This installation has now been running for some time without a hitch of any kind, and has given every satisfaction.

Messrs. Bradshaw & Gass, of Bolton, are the architects for the new buildings, and have throughout superintended the electric lighting arrangements, and much credit is due to them for the care and attention they have bestowed upon this matter.

THE SHIPPING ON THE AMERICAN LAKES.—The way in which the shipping on the great lakes is growing, and the increase in the size of the vessels now being employed, may be gauged by the fact that in the month of July eleven new steamers and two sailing vessels were registered in the inland Lloyd's, of an aggregate tonnage of over 14,000 tons, and valued at 1,400,000 dols. More than one-half of the vessels exceeded 1,000 tons, and three of them were over 1,500 tons. The traffic on the lakes is rapidly extending, and an idea of its present volume may be gathered from a report that has been made in connexion with the breaking of a lock-gate at Sault Ste. Marie, a few weeks ago. During the 88 hours the traffic was interrupted, no less than 265 vessels were delayed, having a tonnage of 248,489 tons. Passengers to the number of 1,362 were also detained, including 1,300 tourists. It is estimated that the loss to vessel-owners alone was 80,000 dols. per day, and the daily loss to the country at large over 500,000 dols. The canal and lock, on Canadian territory, which is now being constructed, will not be completed till 1892. It will be about 3,700 ft. long, and the length of the lock 600 ft. When it is finished it will render Canada independent of the United States canal, and at the same time provide an alternative channel between Lakes Superior and Huron, which is badly wanted, owing to the rapid development of the mineral traffic on Lake Superior.

SHELTER FOR OFFICER ON BRIDGE OF STEAMERS.

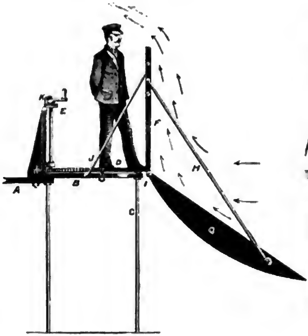
THE hardships to which officers in charge of steamships, while on duty on the bridge, are exposed are little understood by those "who stay at home at ease," but nevertheless these are real and severe. The usual shelter afforded them is derived from a strip of canvas about breast high, and leaving the upper portion of the body and the face exposed to the full fury of the gale. This was supposed to be unavoidable, as of course it was necessary that he should have a free and uninterrupted look-out ahead.

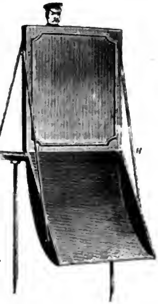
It was reserved for Henry Lloyd Meadows, Esq., M.A., Clerk to the Crown and Peace for the County of Wexford, Ireland, to bring about a change in this matter, and by his inventive genius to supply the necessary protection, while leaving the freedom of vision obtaining in the old arrangement.

Mr. Meadows' invention is not only simple but thoroughly effective. It consists of a movable platform, worked on a swivel attached to the bridge, and on which the officer in charge stands. To the front of this platform is screwed a zinc or metal plate, which reaches to the height of an average-sized man's shoulders, and which thoroughly shelters him so far. In addition, and in continuation to this, Mr. Meadows provides, below the bridge, another sheet of metal, concave shaped, which is the important part of his arrangement. When standing on the movable platform, before mentioned, the officer can, by turning a handle at his side, bring this additional screen directly to face the wind, which, on striking the concave part of the shield, receives an upward turned direction, which, impinging on the upper shields, is necessarily carried well over the head of the observer on the bridge, and acts as an effectual guard against wind, however strong, from striking directly on the face, thus leaving all the free and full look-out of the old style, without any of its bitter discomforts. It may be added that when in dock or in calm weather this lower screen can be folded up so as to be out of the way.

Our illustration shows at a glance the simplicity, yet thorough efficiency of this invention. A is part of the vessel's bridge; B, a platform bolted to it; C, a support to this platform; D, the swivel floor on which the officer stands; E, the gear for turning the concave part of the shield to the wind; F, the screen in front; G, the scoop to direct the wind up the screen F—indicated by the arrows; H H are rods to set scoop G to the proper angle; J, the hinge joint to turn scoop up when not required; and I I are backstay rods to screen; while K is a looking pawle.

This simple but effectual invention should recommend itself to both Mercantile Marine and Navy authorities all over the world.



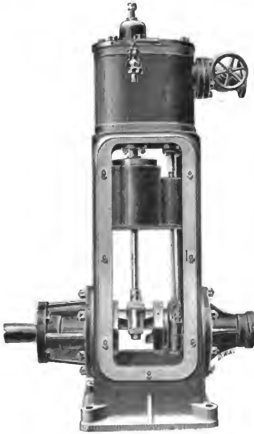


TAYLOR'S AUTOMATIC DISINFECTOR.—We had the pleasure the other day of inspecting, at the offices of the Sanitation Co., at 14, Victoria Street, Westminster, a model of an invention by Mr. George Taylor, of the Steel Street Glass Works, Liverpool, for applying an effective disinfectant to closets and other conveniences where water is used for flushing purposes. Mr. Taylor's invention is a very simple one and consists of an inverted bottle containing a disenfectant fluid—Condy's for choice. This bottle is furnished at its mouth with a syphon tube which discharges somewhere about a teaspoonful of the disinfectant every time the closet is used, this mixes with the water and passes down the soil pipe, a certain amount of course remaining in the trap. The discharge from the bottle stops as soon as the valve of the flushing tank is closed and thus any waste of the disinfecting fluid is avoided, no matter whether the closet be used once or twenty times a day. The contrivance utilises a natural physical law, and while being interesting from a scientific point of view it undoubtedly provides a reliable and effectual closet automatic disinfector. We understand it is the intention of the inventor to supply the proper-sized bottle charged with the disinfectant at one shilling each so that there may be no difficulty about refilling. This price is under what Condy's fluid can be purchased at without the bottle. We may add that medical officers of health and sanitary authorities are more than satisfied with Mr. Taylor's invention, and we hope to see it generally adopted in the Mercantile Marine.

CHANDLER'S PATENT "SILENT" HIGH-SPEED ENGINE.

OUR illustrations show one of these engines coupled direct to a Crompton dynamo. Four sets very similar have recently been supplied to Messrs. Thos. Cook & Sons for lighting their Nile steamers, they having had excellent results from a similar set supplied to them over a year ago. The speed is 500 revolutions per minute, full load 130 lamps, steam pressure 130 lbs.

The arrangement is very compact, yet every part is completely accessible. Fig. 2 shows one of these engines with the large doors removed from back and front, and when fitted with oil cups and boxes can be employed as an open engine to satisfy those who are prejudiced against the "closed" type of engine. We feel confident, however, that if engineers would only try this engine with the doors on, they will never wish to remove them. These engines were selected for driving the fans on the s.s.'s *Teutonic* and *Majestic*, the builders thoroughly testing both engines and fans under extremely severe circumstances before ordering 14 engines and fans for each steamer. It will be observed that all Chandler's patent engines are fitted with ordinary pistons, rods, and stuffing boxes under the cylinders, also valve rods and stuffing boxes; thus there is no leakage past the pistons and valves into the crank chamber, and the pistons and cylinders are not cooled at every stroke by being open at the bottom to the atmosphere. These engines appear to be highly suitable for use on board steamers, as they exhaust to condenser and yet work perfectly silent, the vacuum acting on the under side of the pistons during the *down stroke*, thus increasing the power of the engine. The stuffing boxes prevent any air or oil from passing from the crank chambers to the condenser with the exhaust. We understand that no less than 18 of the British India Steam Navigation Co.'s steamers are fitted with these engines, driving dynamos direct, giving from 100 to 400 lamps. As may be seen, the bearings are of great length of London phosphor bronze, and the crank shafts are of Siemens-Martin steel. Messrs. Bumsted & Chandler, engineers, Hednesford, make these engines either with single or double cranks, and either simple, compound, or triple expansion, as may be desired. The latter types being economical to the highest degree.



NAVAL NOTES.

WORK IN THE ROYAL DOCKYARDS.

WORK on the various vessels in process of construction at the Royal Dockyards is progressing at a rapid rate, and several ships are in such a forward state that the dates of consignment to their natural element are not remote.

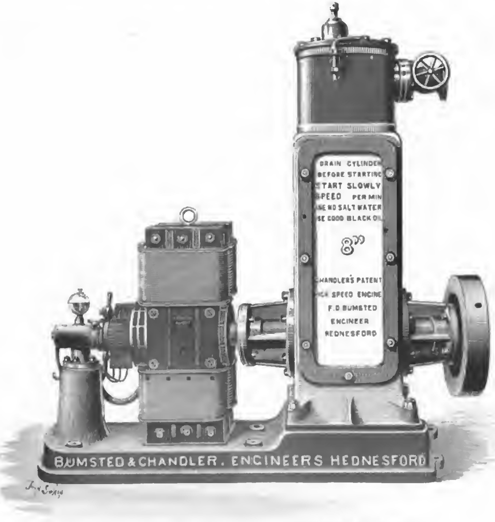
The launch of the *Edgar*, building at Devonport, will take place on the 25th of November, and the event is being looked forward to with more than usual interest in the locality, as it is reported that Her Imperial Highness the Duchess of Edinburgh will perform the launching ceremony. The *Edgar* is a steel cruiser of the protective deck type, and measures 360 ft. in length between perpendiculars, by 60 ft. in extreme breadth, by 23·9 ft. draught, the displacement at this draught being 7,350 tons. Triple-expansion engines will be fitted, to drive twin-screws, capable of developing collectively 12,000 I.H.P., from which a speed of 19·5 knots is expected. The protective steel deck which runs right fore and aft, has a maximum thickness of three inches, and upon it, where the cylinders pass through, an armoured breastwork is built for their protection, consisting of steel plates 5 in. thick, supported by a backing of teak 8 in. in thickness In the construction of the *Edgar* much has been embodied that is new, and her future performances will be keenly watched by naval experts.

Early in the month the *Centaur*, a vessel in many respects similar to the *Edgar* although of larger displacement, is destined to leave the slipway at Portsmouth. She is 360 ft. in length; 60·7 ft. in breadth; and 24·7 ft. draught, with a displacement of 7,700 tons. To give her a large radius of action she is provided with a bunker capacity of 850 tons; and will be fitted with triple-expansion engines to develop upwards of 12,000 I.H.P. Her armament will consist of two 9-25-inch 22 ton breachloading guns, ten 6-inch, and a number of quick-firing guns, besides four torpedo tubes.

At Chatham the *Apollo*, a cruiser of somewhat smaller dimensions, will be put into the water about the middle of the month. This vessel was commenced in August of last year, and regardless of the anxiety of her constructors to see her in the water, she has been kept on the stocks for a considerable time awaiting the arrival of her stem shafts from the contractors. Her principal dimensions are as follows:—Length, 300 ft., breadth, 43 ft., mean draught of water, 16 ft. 6 in., with a displacement of 3,400 tons. Two sets of triple-expansion engines will be fitted to develop collectively 9,000 I.H.P., the speed expected being 20 knots. Her bunker capacity is 400 tons, but in case of necessity additional storage is provided for other 200 tons. The armament will be made up of two 6 in. breech-loading guns, six 4·7 in. and eight 6-pounder quick-firing guns, and one 3-pounder gun. In addition she will carry twelve Whitehead torpedoes.

Of the *Centaur* it may be said that the rate of her construction has been phenomenal; but although the policy of dispatch is desirable from an economical point of view, it is hardly politic, and certainly not necessary, that constructors engaged in the supervision and building of vessels in Her Majesty's dockyards should vie with one another in the expedition and cheapness of doing work, as if carried to extent—and the inclination is that way at present—the elements of shoddy and sham are bound to find their way into the hulls of vessels in which, practically speaking, rests the welfare of the nation. It is greatly to be hoped, however, that when this trio of cruisers are ready for actual service they will prove more profitable than a few others of recent construction.

The first-class unarmoured cruiser, *Hawk*, of 7,350 tons displacement, building at Chatham, is fast nearing completion and will soon be ready to take the water, while the *Royal Sovereign*, first-class battleship, laid down at Portsmouth just twelve months ago, is advancing at such a rate that it may be fully expected she will leave her berthplace early in the spring of next year. The *Royal Sovereign* is the largest armour-clad hitherto constructed in a royal dockyard, her designed displacement at 27·5 ft. draught of water being 14,150 tons, and she will, when completed, surpass both in auxiliary armament and speed all existing types of first-class battleships in the Navy. Her length is 380 ft., and breadth 75 ft., and at the water line she will be protected by a belt of armour 8·5 ft. broad, extending over two-thirds of her length, with a maximum thickness of 18 inches. The propelling machinery will consist of two sets of triple-expansion engines having a maximum power under forced draught of 13,000 horses, which is deemed sufficient for a speed of 17·5 knots. The coal carried will amount to 900 tons, which will enable her to steam at least 1,500 knots at the maximum rate of speed.



Chandler's Patent "Silent" High-Speed Engine—*see page* 344.

During the month of October the keels of two large vessels were laid, that of the *Crescent*, a steel protective cruiser of 7,700 tons displacement, at Portsmouth, and that of the *Barfleur*, second-class battleship of 10,500 tons, at Chatham. Preparations are also being made at Portsmouth for the construction of a sister ship to the *Barfleur*, and to be named the *Centurion*. Each of the latter vessels will measure 360 ft. 6 in. in length by 70 ft. in extreme breadth, and will be provided with triple-expansion engines to develop upwards of 12,000 I.H.P., which will enable them to rival in speed the *Royal Sovereign*.

Fresh interest has been awakened in the torpedo gunboat *Sharpshooter*, for, after repeated failures and breakdowns, the contractors have at length succeeded in putting her through the natural draught trial as stipulated by the Admiralty regulations, at which a speed of 16·5 knots was obtained with the engines indicating a little over 3,000 H.P. Satisfactory results have also been obtained with the first-class gunboats *Ringdove* and *Lapwing*, of 805 tons displacement. During their natural draught trials at Plymouth speeds of 13 knots and 12·5 knots respectively were obtained, the engines in each case developing about 720 I.H.P.

Warships with Triple Screws.

Although naturally somewhat conservative in adopting new designs, the official experts in the constructive department of the Admiralty are not slow to interest themselves in matters which come before them, sanctioned by partial use elsewhere or approved by outside authorities. One question which has engaged the attention of Sir Nathaniel Barnaby while in the United States with the Iron and Steel Institute is likely to be brought before our naval authorities by that gentleman, and is bound to create interest. This is the adoption of triple propellers in a swift man-of-war, which the American naval authorities are about to build. The sea speed of this vessel, tenders for which have not yet been returned by builders—is to be 21 knots, with a power of 20,500 I.H.P. This is greater than in any British ship. Each of the three screws will be driven by separate triple-expansion engines. The centre screw will be placed amidships, as in a single-screw steamer, and will be 4 ft. 6 in. below the other two, which will be placed at either side, as in the case of a twin-screw vessel. One undoubted advantage is that the vessel may be driven by the centre screw only when cruising, and by the three at full speed. Thus, each engine may be worked at its maximum revolution, which, relatively to power, is the most economical, and the speed will be variable according to the number of engines working. Each shaft has gearing for disengaging it from the engine, so that any of the propellers may revolve at will when the steamer is being moved by the others. The engines do not require to be of the same power, as in the case of twin-screws, and the strain on the shaft is not so great, while there is less risk of complete breakdown by the triplicity of engines.

France has tried the three screws, but since the time of the famous Russian royal yacht, *Livadia*, nothing practical has been done in this direction in our own country. Engineers are not, however, blind to the advantages of the system where great power has to be transmitted, or where exceptional conditions as to draught have to be fulfilled. In proof of this, we need go no farther than our own columns, and refer to our May issue, in which is described and illustrated the system of triple-screws driven by a single set of triple-expansion engines, as conceived and patented by Mr. Hugh Dunsmuir, of Govan. This system is being applied, we believe, to two vessels by Messrs. Dunsmuir & Jackson, and doubtless the venture will throw considerable sidelight on the subject, as applied to powerful men of war.

THE ADMIRALTY AS ENGINE-BUILDERS.

The Admiralty have, it is said, decided on a step which is fraught with consequence to many of the large private firms on the Clyde, Thames and Tyne. Until two or three years ago, all the engines for British war ships, built in the royal dockyards, were constructed by contract by private firms, but some little time ago one or two small sets were ordered to be built at Sheerness and Devonport, and recently the engines for the *Phœbe*—7,500 H.P.—were ordered to be constructed at the latter port. The policy thus inaugurated is to be further pursued, and instead of depending, as formerly, on private establishments, the work of engine-making will in future be undertaken to a considerable extent by the Admiralty at Portsmouth and Chatham. Of course private firms will still get orders, but they will be fewer, and the competition by Government establishments will mean less profit. The significance of this step will be appreciated when it is remembered that many London firms practically live by Government engineering contracts, while for engines for ships built in royal yards, as well as on the Clyde, Messrs. Napier & Sons have taken considerably over half a million, Elder & Fairfield £400,000, Thomson £360,000, and others corresponding amounts.

TRADE ON THE WEAR.—The River Wear Commissioners issued the trade return of Sunderland for the last month, which shows a large falling off in comparison with last year. The port dues totalled about £4,000, as against £5,000 during the corresponding period of last year. Fifty-nine fewer vessels visited the port, and the tonnage shows a decrease of nearly 28,000 tons. The quantity of coal shipped was about 29,000 tons less, and the total port dues and dock rates represent a decrease of nearly £2,000.

ADDITIONS TO THE FRENCH NAVY.—The three first-class ironclads, provision for which was made in the Naval Estimates this year, will be laid down early in the coming year, and they are to be named the *Lazare Carnot*, the *Charles Martel*, and the *Jauréguiberry*. The first-named is to be built at Toulon, on the same stocks as the *Magenta*, which was launched last spring in presence of the President of the Republic. It will be 380 ft. long by 70 ft. broad, with a draught of 27 ft., and a displacement of 11,988 tons. It will be of 12,400 H.P., with a corresponding speed of 17 knots an hour, which can be raised to 18 if required. The principal armament of the vessel will be composed of two 12-in. guns, two of 11 in., and eight of 6 in., all in turrets, this being exclusive of 22 small rapid-firing and repeating guns. The *Lazare Carnot* will have armour-plates of the maximum thickness of 18 in., while the *Charles Martel*, which is to be built at Brest, while having the same armament and armour-plate as the *Lazare Carnot*, will differ in dimensions, being 391 ft. long by 70½ ft. broad, 27 ft. draught, and a displacement of 11,882 tons. The engines will be of 12,000 H.P., with a normal speed of 17 knots. The plans for both these vessels have received the approval of the Minister of Marine, and orders have been given for them to be begun, whilst those for the *Jauréquiberry*, which is to be built at the docks of the Forges et Chantiers Co., on the Mediterranean, have not yet been definitely settled. But all three vessels will be noted for their great speed and powerful armament, their tonnage being about the same as that of the *Formidable* and the *Admiral Baudin*.

THE SERVE RIBBED BOILER TUBE TRIALS AT SHEFFIELD.

WE fully described this boiler tube in our number for June, 1889, pages 115-118, No. 123, vol. XI. From the description then given it may be remembered that the difference between the Serve tube and the ordinary one consists in the former being furnished with inside longitudinal ribs, which, presenting a larger surface to the gases passing through them are expected to absorb a greater amount of the heat of those gases before they reach the funnel.

We were present at a series of exhaustive trials of these tubes at the Atlas Works of Messrs. John Brown & Co., Limited, Sheffield, who, having satisfied themselves as to their merits for boilers and other purposes, have undertaken their manufacture.

In order to give every engineer an opportunity of seeing for himself the advantages these tubes afford in greatly increased steam producing power, per boiler and per pound of fuel, this eminent firm completed at their works two ordinary single-ended marine boilers identical in every respect. No. 2 was fitted with the usual plain tubes, and No. 1 with the "Serve" tubes.

The trials took place on the 21st, 22nd, 23rd, and 24th of October last, and a number of prominent engineers, officials of the Admiralty and Lloyd's, as well as of foreign governments, were invited to be present.

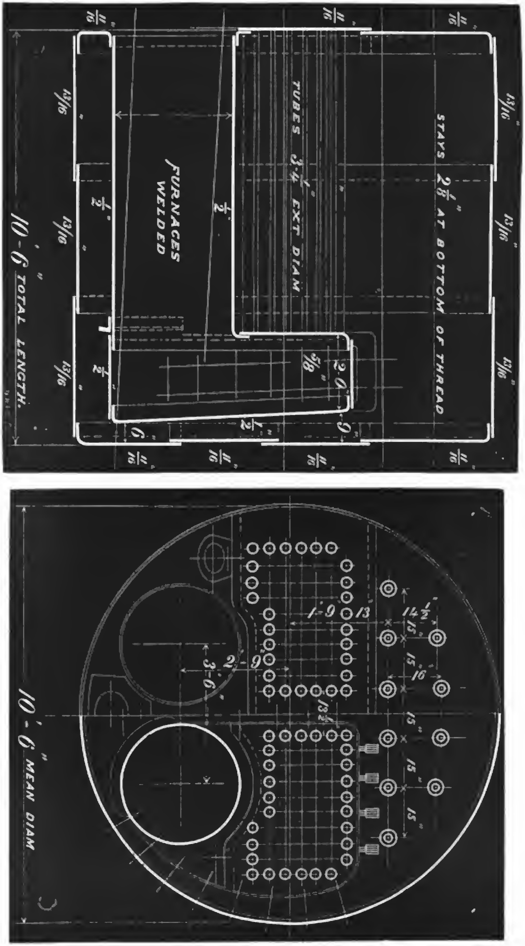
The following are the details of the boilers:—

	No. 1.	No. 2.
Diameter of boilers	10 ft. 6 in.	10 ft. 6 in.
Length of boilers	10 ft. 6 in.	10 ft. 6 in.
Inside diameter of furnaces (two in each boiler)	2 ft. 10½ in.	2 ft. 10½ in.
Total number of tubes	126	126
Outside diameter of all tubes	3¼ in.	3¼ in.
Thickness of ordinary steam tubes	⅛ in.	⅛ in.
Number of stay-tubes	34	34
Thickness of stay-tubes	⅛ in.	¼ in.
Length of furnaces and of all tubes inside of boiler	7 ft. 6½ in.	7 ft. 6½ in.
Heating surface of each ordinary tube	10·42 sq. ft.	5·95 sq. ft.
Heating surface of each stay-tube	10·42 sq. ft.	5·45 sq. ft.
Total heating surface of tubes	1312·9 sq. ft.	732·7 sq. ft.
Area of grate surface	31 sq. ft.	31 sq. ft.
Heating surface of furnaces	135·5 sq. ft.	135·5 sq. ft.
Heating surface of combustion chamber	88 sq. ft.	88 sq. ft.
Total heating surface of boilers	1536·4 sq. ft.	956·2 sq. ft.
Proportion of grate to heating surface	1 in 49·56	1 in 30·84
Total tube area for passage of gases	802·36 sq. in.	852·18 sq. in.
Section of fire-bars	1 in. sq.	1 in. sq.
Distance between fire-bars	½ in.	½ in.
Funnel, rectangular section	4 ft. x 2 ft.	4 ft. x 2 ft
Height of funnel from top of combustion chamber	43 ft. 7 in.	43 ft. 7 in.

Coal used, Nixon's Navigation.

The chimney (4 ft. square) was divided, throughout its entire height, exactly in two halves, 4 ft. by 2 ft. rectangular section. Two Martin's fans and engines, exactly alike, were fitted, one set to each half of chimney, for producing *induced accelerated* draught and four cast-iron square water-feeding tanks—planed to template to insure uniformity—were provided, two tanks being assigned to each boiler. One inch of depth on gauge-glasses, equalling ten gallons of water. Each boiler had water, draught, and heat indicators.

It will be seen that as a basis for comparison, the same number of tubes with an equal *outside* diameter has been adopted, although this does not give full justice to the ribbed tube, the ribs naturally reducing the sectional area for the passage of the gases. Part of this loss is however recovered by using *thin stay* tubes in No. 1 boiler as the ribs give the tensile strength required. This leaves boiler No. 2 finally with an



Section of Boilers Tested at the Atlas Works, Sheffield, on 21st, 22nd, 23rd and 24th October, 1890. *See page 340.*

advantage of 50 *square inches* more area for the passage of the gases. Boiler No. 1 cannot therefore have quite as much draught as No. 2, when working with *natural* draught, and when both boilers are working at the same pressure of *induced accelerated* draught, much more air must pass through No. 2 than No. 1.

We were shown specimens of *stay* tubes with "welded" and with "brazed" ferrules, the "brazed" tubes stand a tensile strain of 40 tons without disturbance as a complete tube. All the ribbed tubes being thin, this brazed arrangement and consequent saving in weight, compensates to a considerable extent for the extra weight in the thin tubes, caused by the addition of the ribs. Incidentally, the experiments under consideration were used to try in each boiler in equal numbers "stay" tubes with *welded* and with *brazed* ferrules; also tubes covered inside and outside with a hard alloy of tin and antimony.

Martin's induced accelerated draught, used on this occasion, we fully explained, and gave the results of the Government trials with a locomotive type of boiler, in our issues of May and September last. We may, however, here state that the draught is obtained by means of a fan placed at the foot of the chimney, or at any convenient place beyond the smoke-box. According to the number of fan revolutions, the hot gases are *drawn* through the tubes from the furnaces at a proportionate velocity. The advantage of this system, compared with *forcing* air through the tubes, is that the blowpipe action upon the combustion chamber tube-plate is avoided, as the gases are drawn from the furnaces in steady streams into the tubes without impinging upon the tube-plate. The usual troubles arising from very hot tube-plates and tube-ends are thus avoided.

The first day's running was devoted to a three hours' comparative test of the two boilers working with "induced accelerated" draught at a pressure of 1½ in. in the smoke-box of both boilers; and a further three hours' comparative test with "Natural draught" in both boilers, blowing the steam off in the air, and the following are the results:—

Three hours with "induced accelerated" draught at the pressure of 1½ in. in smoke box in both boilers.

		Boiler No. 1. Serve.		Boiler No. 2. Plain.
Total coal burnt	.. ..	34 cwts.	..	37 cwts.
Evaporation in half-hour	..	345 galls.	..	310 galls.
,, ,, 1 ,,	..	935 ,,	..	870 ,,
,, ,, 1½ hours	..	1555 ,,	..	1465 ,,
,, ,, 2 ,,	..	2115 ,,	..	2030 ,,
,, ,, 2½ ,,	..	2645 ,,	..	2510 ,,
,, ,, 3 ,,	..	3250 ,,	..	3100 ,,

COMPARATIVE RESULT.

Evaporation in No. 1 boiler	.. ..	4·8 per cent. more.
Economy in fuel in No. 1 boiler..	..	14·1 per cent.

Three hours with "natural" draught in both boilers.

		Boiler No. 1. Serve. Cwts. Qrs. Lbs.		Boiler No. 2. Plain. Cwts. Qrs. Lbs.
Total coal burnt	.. ..	16 ,, 0 ,, 18	..	20 ,, 0 ,, 0
Evaporation in 1 hour	..	605 galls.	..	640 galls.
,, ,, 1½ hours	..	920 ,,	..	980 ,,
,, ,, 2 ,,	..	1210 ,,	..	1300 ,,
,, ,, 2½ ,,	..	1510 ,,	..	1680 ,,
,, ,, 3 ,,	..	1820 ,,	..	2010 ,,

COMPARATIVE RESULT.

Evaporation in No. 1 boiler	.. ..	9·4 per cent. less.
Economy in fuel in No. 1 boiler	.. ..	12½ per cent.

Not reduced to "from and at 212°."

The second day's trial, that of 22nd October, was one of twelve hours duration, commencing at 8 a.m. and continuing without interruption to 8 p.m., and was devoted to working No. 1 boiler, with ribbed tubes, at the highest possible induced draught obtainable with the appliances present, and with ordinary working pressure; and working No. 2 boiler, with plain tubes, in such a manner as to arrive at exactly the same combustion of fuel. The object being to ascertain the highest amount of extra evaporation from boiler No. 1 at equal combustion in both boilers.

Twelve hours of "Induced Accelerated" Draught on the basis of "equal" coal consumption, the draught being regulated accordingly.

BOILER No. 1.

Hours.	Coal Burnt in Pounds.	Water Evap'rated in Pounds.	Vacuum at Base of Chimney.	Steam Press're in Lbs.	Temp. of Feed.	Remarks.
1 hour	1568	9000	1¼ in.	16½	59°	Steam blowing off into the air, but the open Safety Valves (two openings 3¼ in. diameter) could not get rid of it without pressure accumulating.
2 hours	2800	19300	1 in.	12½	66°	
3 ,,	3808	27000	1¼ in.	15	60°	
4 ,,	4928	39800	1¼ in.	11	61°	
5 ,,	5824	49600	1 in.	10	60°	
6 ,,	6832	59300	1¼ in.	11	60°	
7 ,,	7504	68600	1¼ in.	10	60°	
8 ,,	8400	77200	1¼ in.	10	60°	
9 ,,	9520	87300	1¼ in.	11½	60°	
10 ,,	10416	96000	1¼ in.	10¾	60°	
11 ,,	11200	105800	1⅛ in.	10¼	60°	
12 ,,	11872	114600	1 in.	10	60°	

BOILER No. 2.

Hours.	Coal Burnt in Pounds.	Water Evap'rated in Pounds	Vacuum at Base of Chimney.	Steam Press're in Lbs.	Temp. of Feed.	Remarks.
1 hour	1568	7800	1⅛ in.	9½	59°	Ditto.
2 hours	2800	16200	1¼ in.	8½	61°	
3 ,,	3808	25300	1⅛ in.	9	61°	
4 ,,	4928	34400	1¼ in.	6	60°	
5 ,,	5824	43000	1⅛ in.	6	61°	
6 ,,	6832	52300	1⅛ in.	10	60°	
7 ,,	7504	61500	1⅛ in.	6½	61°	
8 ,,	8400	69300	1⅛ in.	6¾	60°	
9 ,,	9520	78500	1¼ in.	8	60°	
10 ,,	10416	87500	1 in.	6¾	60°	
11 ,,	11200	95100	1⅛ in.	4½	61°	
12 ,,	11872	103000	1⅛ in.	6¼	60°	

These results show a greater evaporation of 11·26 per cent., and the coal consumption makes the evaporation equal to—

11·19 lbs. of water per lb. of fuel for No. 1 boiler.
10·05 ,, ,, No. 2 ,,
From and at 212°.

The third day of the experiments was devoted to a seven consecutive hours' steaming at a uniform vacuum pressure of ¾ in. at the base of the chimney in both boilers The following are the results:—

BOILER No. 1.

At the end of	Coal Burnt.	Water Evaporated in Pounds.	Vacuum Pressure	Steam Pressure.	Temperature of Feed.	Remarks.
1 hour	Total: 6496 Pounds.	7500	¾ in.	11 lbs.	63°	Steam blowing off through two open (unloaded) Safety Valves each 3¼ in. diameter.
2 hours		17600	¾ in.	12¼ ,,	60°	
3 ,,		26900	¾ in.	9 ,,	64°	
4 ,,		35400	¾ in.	9 ,,	62°	
5 ,,		44300	¾ in.	8¼ ,,	63°	
6 ,,		53000	¾ in.	9 ,,	63°	
7 ,,		61500	¾ in.	9 ,,	62°	

BOILER No. 2.

At the end of	Coal Burnt.	Water Evaporated in Pounds.	Vacuum Pressure.	Steam Pressure.	Temperature of Feed.	Remarks.
1 hour	Total: 6,496 Pounds.	6300	¾ in.	8¾ lbs.	64°	Steam blowing off through two open (unloaded) Safety Valves each 3¼ in. diameter.
2 hours		15300	¾ in.	6¾ ,,	66°	
3 ,,		23400	¾ in.	4½ ,,	62°	
4 ,,		30400	¾ in.	4½ ,,	62°	
5 ,,		38200	¾ in.	4 ,,	63°	
6 ,,		45800	¾ in.	4½ ,,	63°	
7 ,,		53200	¾ in.	4¼ ,,	62°	

Boiler No. 1—Evaporation = 15·6 per cent. more than No. 2
,, No. 1— ,, = 11·03 lbs. of water } per lb. of fuel
,, No. 2— ,, = 9·50 ,, } from and at 212°

The concluding day of the experiments was devoted to a 7¼ consecutive hours' steaming at a vacuum pressure, at the base of chimney, of ⅝-in. for Boiler No. 1, and of ½-in for Boiler No. 2. This difference in vacuum was found by the combustion to rather more than balance the difference in tube area between the two boilers. The following are the results:—

BOILER No. 1.

At the end of	Coal Burnt.	Water Evaporated in Pounds.	Vacuum Pressure.	Steam Pressure.	Temperature of Feed.	Remarks.
1 hour	Total: 5712 Pounds.	6600	[illegible] in.	9 lbs.	65°	Steam blowing off through two open (unloaded) Safety Valves, each 3½ in. Diameter.
2 hours		15200	[illegible] ,,	8½ ,,	62°	
3 ,,		23300	[illegible] ,,	7 ,,	66°	
4 ,,		31300	[illegible] ,,	7½ ,,	64°	
5 ,,		39100	[illegible] ,,	7 ,,	64°	
6 ,,		45300	[illegible] ,,	6¼ ,,	63°	
7½ ,,		56100	[illegible] ,,	6¼ ,,	63°	

BOILER No. 2.

At the end of	Coal Burnt.	Water Evaporated in Pounds.	Vacuum Pressure.	Steam Pressure.	Temperature of Feed.	Remarks.
1 hour.	Total: 5404 Pounds.	6000	½ in.	4½ lbs.	68°	Steam blowing off through two open (unloaded) Safety Valves, each 3½ in. Diameter.
2 hours.		13400	½ ,,	4½ ,,	65°	
3 ,,		20000	½ ,,	3¾ ,,	64°	
4 ,,		27100	¼ ,,	4 ,,	65°	
5 ,,		33500	½ ,,	3 ,	64°	
6 ,,		38600	¼ ,,	3¼ ,,	65°	
7½ ,,		48400	¼ ,,	3 ,,	63°	

Boiler No. 1—Evaporation = 15·9 per cent. more than No. 2.
,, No. 1— ,, = 11·39 lbs. of water } per lb. of fuel
,, No. 2— ,, = 10·36 ,, } from and at 212°

During these experiments the temperatures were taken by means of a Richard Fréres Azotic Gas Pyrometer, but as this seems to register the heat higher than we are accustomed to in this country, we have not given any records of it, but have confined our report to those items on which we are sure. These results seem amply to establish the superiority of the Serve tube, this being very marked when working with induced accelerated draught. The steam made during all the trials was blown to waste through the open safety valves, but there was still a slight pressure in the boilers, which in both was pretty much alike.

The arrangements made for the trials were very complete and perfect, and everything was done to render the tests as fair and impartial as possible. The fires of both boilers were throughout treated exactly alike, and each boiler had its own pair of feed tanks with independant service and connections, and everything appeared to work smoothly and without the slightest hitch. All the officials connected with the trials were indefatigable in their efforts to promote the comfort and convenience of the many visitors who came from all quarters of the globe to satisfy themselves by personal observation of the merits of the Serve tube. These merits are undoubtedly great, and while the trials were no doubt made under the most favourable circumstances, yet we have no doubt that under the more exacting conditions of actual service at sea they would give a good account of themselves. We understand that further experiments are to be made in a week or two, when it is expected to get up to three times the combustion and evaporation of natural draught.

THE CARDIFF DOCK SCHEME.—Negotiations are in progress, and seem in a fair way to be successfully completed, for the amalgamation of the Bute, Taff, and Barry Dock and Railway Companies, representing in all something like 16 millions of paid-up capital, and if the Rhymney Railway Co. be included in the amalgamation the total sum will reach 20 millions. Those "in the know" are very reticent about the matter, but notices to bring forward a bill for the proposed amalgamation will be given before the end of November, in time for dealing with the matter next session. One great bar to the credence of the published accounts is that Sir W. T. Lewis (Lord Bute's chief agent) is at present in America with the Iron and Steel Institute, although on the other hand it is asserted that Sir William is quite aware of the negotiations being carried on. It is understood that the overtures for union originated with the Bute trustees. The suggestion has also been made that a "trust" should be created. We are, however, able to say that there will be a joint control of all the bodies interested. The only opposition expected is on the part of freighters, and we have every reason to believe that their interests will be so effectually safeguarded that not only will opposition be disarmed but even turned into support.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 26th to October 25th, 1890:—

Burner, Wm. H., staff engineer to the *Anson*, to date October 14th.
Cawley, John A., engineer to the *Pembroke*, additional, to date September 27th.
Comley, Edwin J., fleet engineer to the *Assistance*, to date September 27th.
Gay W. H., chief engineer to the *Terpsichore*, to date September 27th.
Goodwin, Geo. G., engineer to the *Pembroke*, to date October 1st.
Glasspole, Wm. H., assistant engineer to the *Euphrates*, to date September 27th.
Graham, James E. D., chief engineer to the *Pylades*, to date September 29th.
Guise, Bertram J. R., engineer to the *Hero*, to date October 3rd.
Gyles, David G., staff engineer to the *Euphrates*, to date October 2nd.
Harding, F. G., engineer to the *Chasseur*, to date October 24th.
Harding, Robert, chief engineer to the *Vernon*, additional, October 14th.
Hobbs, Frederick D., engineer to the *Asia*, to date October 1st.
Hornby, Richard S., engineer to the *Icarus*, to date October 24th.
Lane, James, engineer to the *Satelite*, to date October 24th.
Lister, Francis H., engineer to the *President*, to date November 1st.
Lonnon, Wm., chief engineer to the *Inconstant*, to date October 2nd.
Ludgate, Wm. G., engineer to the *Thunderer*, to date October 3rd.
Marrack, Philip, engineer to the *Indus*, to date October 1st.
Maddus, Harry H., engineer to the *Calliope*, to date September 27th.
Mitchell, G. N. H., staff engineer to the *Monarch*, to date October 24th.
Odam, Edwin K., engineer to the *President*, additional, to date November 1st.
Pattison, Alfred R., engineer to the *President*, to date November 1st.
Peel, Henry C. W., engineer to the *Iris*, to date October 20th.
Purvis, Alexander, fleet engineer to the *Glatton*, to date October 14th.
Rush, Henry C., assistant engineer to the *Malabar*, probationary, to date October 4th.
Sampson, John G., fleet engineer to the *Swiftsure*, to date October 4th.
Screech, Samuel A., engineer to the *Alexandra*, to date September 27th.
Teed, Henry R., assistant engineer to the *Indus*, to date October 4th.
Vine, E. R., staff engineer to the *Royal Sovereign*, to date October 24th.
Vining, Henry P., engineer to the *Asia*, additional, to date September 29th.
Welby, Thos., engineer to the *Sheldrake*, to date October 2nd.
Williams, Stephen B., fleet engineer to the *Comus*, to date October 2nd.
Willoughby, Jas. T., acting engineer to the *Indus*, to date October 4th.

HAACKE'S PYROSTAL COMPOSITION.—We understand that Messrs. A. Haacke & Co., of Kieselguhr Wharf, Hackney Wick, London, have received the "Silver Medal" at the Edinburgh Exhibition, where they covered the main steampipes with their *Pyrostal* composition. This is a non-conducting composition, equal in every respect to their Fossil Meal, with the exception that they use Asbestos fibre, instead of the vegetable fibre, thus enabling them to apply Pyrostal to even red-hot surfaces, and it is specially adapted for covering boilers and steampipes containing 150 to 200 lbs. pressure. This firm's *Antiscale* for the prevention of incrustation and corrosion in steam boilers is well known. This composition is entirely free from anything which can injure the boiler-plates or fittings, and consists only of substances adapted for softening and cleaning feed-waters. After the application of this Antiscale, we understand that the material which formed the hard scale will be found as a soft mud at the bottom of the boiler, and can easily be swept or washed out at the usual cleaning.

HOAR & BROWN'S HARDWOOD MARKET REPORT, Oct. 24th, 1890.

TEAK—	TIMBER. *Lds.*	PLANKS. *Lds.*	BLOCKS. *Lds.*	TOTAL. *Lds.*
Stock, 1st Sept.	9,291	1,703	35	11,029
Landings	918	231	Nil.	1,149
	10,209	1,934	35	12,178
Deliveries	1,510	331	Nil.	1,841
Stock, 30th Sept.	8,699	1,603	35	10,337

The above figures must be regarded as very satisfactory, the totals for the nine months being 9,927 loads of timber and 2,603 loads of planks, as against 9,204 loads of timber and 2,205 loads of planks for the first nine months of last year; an increase of 12 per cent.

Notwithstanding that the landings are 1,149 loads, the stock is reduced to very small figures. Fully four-fifths of this total consists of wood of an inferior character, so that the stock of really good wood is only about 1,500 loads.

The inquiries during the month have been fairly numerous, and several large sales have been effected. Prices are no higher, and are not expected to advance at present, but there is no doubt the market has now reached the lowest point, and after the removal of a quantity of the inferior stock, we may expect to see a steady improvement.

The plank trade has shown a considerable alteration, both in demand and value, and shippers, being full of engagements, are asking high prices for cutting orders.

MAHOGANY.—Stock are being rapidly reduced, and only one cargo is reported close at hand for this market. The short supplies have caused serious inconvenience to the trade, and should an order of any extent be placed upon this market prices would naturally advance still higher. Every public sale shows how eager buyers are, especially for medium and large sizes, and it is confidently expected that prices will continue to advance steadily. There is not so much demand for small sizes, which are ruling lower in comparison. Of Cuba and St. Domingo there still remains a large stock, and very little demand shows itself, consequently prices have not advanced.

CEDAR.—There has been very little done either in the cigar box trade or boat-building, and at present no alteration in prices has taken place, but better times are anticipated very shortly. Stocks are not abundant.

WALNUT LOGS.—Parcels of good quality go readily into consumption at remunerative figures, and more of this description is required. Small and inferior logs find buyers only at greatly reduced prices.

AMERICAN SAWN WALNUT, WHITEWOOD, &c.—Trade is still very dull, although stocks of really marketable goods have been much reduced, enabling shippers to command an increased price for anything good. The market continues heavily weighted with a most inferior and unsaleable class of wood.

OAK remains the same, with little demand.

GREENHEART.—Nothing doing.

PADOUK.—The market remains quiet, and few sales are reported.

KAWRIE PINE.—A slight activity has also shown itself by fits and starts, but no improvement of a general character is expected at present.

SEQUOIA.—The late inquiries have come to very little, and sales from the newly-arrived parcels have been very disappointing.

Business as a whole may be termed fairly good and is expected soon to show considerable improvement.

PASSENGER ACCOMMODATION AT LIVERPOOL.—The Mersey Dock Board, in response to the representations of various Transatlantic steamship companies at Liverpool, have resolved to spend £10,800 in providing further landing accommodation for first-class passengers and Customs examination of their luggage. Additional covered gangways at the landing stage will be provided with another baggage conveyor, so that double the present accommodation will be given. The opinion was expressed that if Liverpool was to compete with other ports provision would have to be made ultimately for passengers [illegible] direct from the steamships, without the employment [illegible] as at present.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE Fairfield Shipbuilding and Engineering Co., Limited, Govan, at the end of last month received an order to build a steamer of 1,650 tons for the Scottish Oriental Steamship Co., most of whose previous vessels have been constructed at Fairfield. The new vessel will be similar in every respect to the *Phra Nang*, the most recent of the company's boats. The Fairfield Co. have also been instructed by Messrs. Donald Currie & Co. to "triple" the engines of their Castle line packets, the *Norham Castle* and the *Hawarden Castle*, built by the company several years ago. The company's works and offices have been for some time back undergoing extension, and their resources are being taxed to produce the four large North-German Lloyd Mail steamers now on hand. The first of these, the *Darmstardt*, was launched on the 10th ult., this, however, being several months behind the time originally contemplated. The remaining three are being vigorously pushed on with.

Messrs. William Hamilton & Co., Port Glasgow, at the end of last month contracted to build for Bailie Taylor, coal merchant, Dundee, &c., a screw steamer to carry 800 tons deadweight, and to steam 14 knots per hour. She will be of a special design, and will trade between Seaham and Aberdeen. The distance is 157¾ miles, and she is expected to do this in one tide or 10¾ hours.

Messrs. Scott & Co., Greenock, at the end of last month contracted to build a steel screw steamer of 600 tons for the Perim Coal Co., of which Mr. Spalding is manager. The builders will construct triple-expansion engines of 200 horse-power, and the steamer is to be engaged in towing in the Red Sea, and in trading between the islands of Perim and Aden, This firm of shipbuilders has also secured an order for two barges, which will be built here and afterwards taken to pieces and sent to the East, where they will be reconstructed.

Messrs. Russell & Co., Port Glasgow, continue to book orders for sailing vessels with a seeming ease and persistency which occasions surprise among their contemporaries. Their three yards are kept taxed to their utmost; no sooner is a hull sent gliding down the ways, than preparations are immediately made for laying another keel. The firm have altogether some 9 or 10 sailing ships in hand or booked, besides work on several steamers. Three of the sailing ships have been ordered since our last month's Notes—a steel ship of 1,700 tons, for Messrs. P. Denniston & Co., Glasgow; one of about the same tonnage for Messrs. Campbell, Finlay & Co., Greenock; and a monster ship, of over 6,000 tons deadweight capacity, for Messrs. Rickmers, of Bremen. This huge sailer, which will be the largest afloat, will have five masts; and it is contemplated to fit her with auxiliary steam machinery for propulsion by a screw propeller. Triple-expansion engines, &c., for this purpose will be furnished by Messrs. Kincaid & Co., Greenock. The shipwrights in the three yards of Messrs. Russell & Co. struck work on the 20th of the month, owing to the joiners in the firm's employ at the Greenock yard having undertaken to do what is alleged to be properly the work of shipwrights. After a general meeting of the men was convened, it was resolved, owing to the dispute being really between two trades, that the carpenters should resume work, pending the settlement of the dispute by the Shipbuilders' Association.

Messrs. McMillan & Son, Limited, Dumbarton, also early in the month contracted to build a first-class steel barque of 2,450 tons burthen, to the order of Mr. William Mitchell, merchant, Londonderry.

Messrs. A. & J. Inglis, of Partick, have contracted to build a steel screw steamer of 800 tons for Norwegian owners. The same firm are also just completing in their dock a large steamer, the *Pentakota*, for the British India Co.

The Grangemouth Dockyard Co. have secured the contract to build a four-masted steel sailing ship to the order of Messrs. John Herron & Co., Liverpool, to carry a deadweight of 4,250 tons, and to be classed 100 A1 at Lloyd's. This enterprising company, it may be added, have recently bought the shipyard and slip-docks at Ardrossan, until lately conducted by the Ardrossan Shipbuilding Co., of which Mr. Mansel and Mr. Aitken, of the well-known Whiteinch firm of Mansel & Aitken, were partners. Under the new *régime*, the Ardrossan yard, which is so favourably situated for ship repairs, &c., may be expected to flourish and develop.

The work upon the Glasgow Harbour Tunnel, which is to cross underneath the Clyde at Finnieston, quite near the point at which is stationed the new elevating ferry steamer described in our last issue, is progressing satisfactorily. The cylinder of the south shaft is now sunk 55 ft., and is resting on the clay, with the exception of a small part on the south side. The cylinder of the north shaft was begun in June, and is now sunk 30 ft. As to the south cylinder, a good deal more work has been done than is represented by the cylinder being sunk 55 ft., because the clay in great part has been excavated to the full depth, and the process of driving the tunnel under the river has been begun. Everything that has happened since the company was started for the formation of this tunnel has gone to prove that it would meet a felt need, and that it will be a most important means of communication. In particular, the recent Parliamentary action of the Clyde Trustees in regard to the Cessnock Dock, and the form which the undertaking has finally taken, made this harbour tunnel a most important link between the docks of the north and south of the river.

The new Renfrew Forge and Steel Works, situated between the Glasgow and South-Western Railway from Paisley to Renfrew and the River Cart, have now been completed. A railway connection has been made with the main line, and lines of rail have been laid down throughout the works, and a connection is being made with a dock in course of construction at the river. The buildings consist of eight spans or bays, the largest of these being 60 feet in width, and covers in all over two acres of ground. They are constructed of iron throughout, the roofs being carried by massive iron pillars and H columns, supporting heavy-built steel girders. The buildings are the work of the eminent Glasgow firm of Arrol Brothers, Germiston Works, from designs furnished by the chairman and manager of the company, Mr. James Millar, late of Kelvin Forge. The forge section of the new works contains, among other steam hammers, one of the largest in Scotland, and is from the latest designs of the well-known firm of Nasmyth, Wilson & Co., Limited, Patricroft. Two steam jib-cranes are fitted in connection with this hammer, working up to 100 tons. They are, in addition to being fitted with steam-gearing for lowering, hoisting, racking out and in, and slewing; fitted with a steam-turning gear, by which the heaviest forgings in the course of manufacture are turned and handled under the hammer with the greatest facility and despatch, and dispense with the services of the numerous helpers employed under the old system. These cranes are also from the works of Nasmyth, Wilson & Co., Limited, and are the only cranes of this description in Scotland. Other cranes of a similar design, and fitted with steam-gearing for the same purposes, have been supplied by the firm of Goodwins, Jardine & Co., Limited, Motherwell. The works throughout have been supplied with every convenience and improvement which modern forethought and skill can suggest for the most rapid and economic production possible. With the large and powerful tools put down the company will be able to undertake, in addition to the ordinary steel and iron forging of every description for marine and other purposes, the construction of heavy guns and ordnance—a branch of industry not yet attempted on the Clyde. The works, it is expected, when in full operation, will give employment to upwards of a thousand men.

Messrs. Alex. Stephen & Son, Linthouse, on Oct. 21st, handed over to Nova Scotian owners a screw steamer which may justly claim to be the fastest single-screw passenger steamer of her dimensions in the world. This is the *Boston*, owned by the Yarmouth Steamship Co., Yarmouth, Nova Scotia, and intended for the passenger trade between Yarmouth, N.S., and Boston. Her dimensions are:—Length, 245 ft. b.p.; breadth, 36 ft.; depth to hurricane deck, 28 ft. 6 in. With 250 tons deadweight on board she attained on the measured mile at Skelmorlie—as the mean of six consecutive runs—a speed of 18·22 knots, or about 1¼ knots over the guarantee. She is propelled by a set of the builders' most improved triple-expansion engines, having cylinders 34 in., 51 in., and 84 in. by 36 in. stroke, which are supplied with steam at 160 lbs. pressure (under natural draught conditions only) from three large steel boilers, having in all 15 furnaces of the Purves ribbed type.

The "first sod" in connection with the forthcoming Glasgow East End Industrial Exhibition was turned, with becoming ceremony, by the Lord Provost on October 11th. This project has met with most gratifying success, the guarantee fund having now reached to between £12,000 and £13,000. The object from the outstart has been to stimulate the inventive genius of thousands upon thousands of artizans dwelling in the east end of Glasgow, to provide healthful and elevating recreation for the people during the Christmas and New Year holidays, and, should there be any surplus—as it is confidently hoped there will be—to establish a permanent Institute for the intellectual and social improvement and recreation of the inhabitants of the vast east end of Glasgow. The scheme has been most enthusiastically taken up and no trouble has been experienced in gathering the sum above mentioned. The site of the exhibition is off Duke Street in the vacant building formerly occupied by a reformatory, together with the surrounding ground—five acres in extent—on which extensive buildings are now being erected. The main building, four stories in height, with central hall and east and west wings, will be devoted almost exclusively to artizans' exhibits in all branches of industry and manufacture. Mechanical engineering will be largely represented, and a large section of the new building is being fitted up for machinery in motion and stalls illustrative of handicrafts in operation. Shipbuilding and engineering will be fully represented, and in this respect it bids fair to rival, if not eclipse, the present Edinburgh show. Indeed, many of the exhibits will be transferred from Edinburgh, while many firms are preparing exhibits which they withheld from Edinburgh. Electric and other modes of lighting, also systems of heating, will form interesting features of the exhibition. A concert hall to hold 2,000 people, forms part of the new building, and fine-arts and natural history collections are to be well represented. The exhibition opens about 15th December, and remains open till end of March. Mr. Henry W. Pearson, who has had charge of similar undertakings, is general manager.

The Ailsa Shipbuilding Co., at Troon, have contracted for the building of two steam yachts—one of 50 ft. in length for a London gentleman, and another of 800 tons to the design of Mr. G. L. Watson, of Glasgow. The latter is to the order of Ninian B. Stewart, Esq., and is a steel vessel 203 ft. long on the water-line, and about 246 ft. along the deck; the difference being made up by an unusually long rakish stern and counter. In the external features and internal arrangements, beauty, luxury and utility, will be cleverly conjoined. Mr. Watson has on hand some half-dozen other steam craft for well-known yachtsmen. The Ailsa Co., it may be added, continue to be excessively busy with repair work in their docks, in addition to the new vessels presently on the stocks.

Messrs. S. McKnight & Co., of Ayr, have secured a contract for the construction of a high-speed passenger steamer, to ply between Bristol and Tenby. The vessel, which is to be built of mild steel, will be of the following dimensions:—Length, 275 ft.; breadth, 24 ft.; depth, 8 ft. 6 in. Machinery will be supplied by Messrs. Hutson & Corbett, Kelvinhaugh, to drive the vessel at a speed of 18 knots.

The British Corporation for the Survey and Registry of Shipping, which was formed at a meeting held some time ago in Glasgow, has now completed its negotiations with the Board of Trade. The question raised by the department has been adjusted, and the memorandum and articles of association will immediately be registered, and a licence obtained for assigning load lines under the Act. The corporation are inviting applications for the appointment of a chief surveyor to the corporation at Glasgow, and for assistant surveyors at Liverpool, London, Newcastle, Hull and Cardiff. The salary proposed in the case of the chief surveyor is not stated, but in the case of the assistants it is from £100 to £150 per annum—not a very alluring figure by any means.

A New Service of Steamers.—On October 7th the Clyde Shipping Co. inaugurated at Dover a new service of steamers between that port and Ireland and Scotland. The company's new steamer, the *Arranmore*, arrived off Dover on the morning of October 7th, and in the afternoon a luncheon was given on board by the directors. Mr. J. C. Cuthbert, the managing director, presided, and there were present, among others, the Mayor and Corporation of Dover, Mr. Knocker, Mr. Cockburn (London, Chatham, and Dover Railway Co.), Sir T. Bruce, R.N., Admiralty superintendent, and Mr. Leyton Lowndes, the deputy-chairman of the Dover Harbour Board, who attended as the representative of Earl Granville, the chairman of the board. The company will convey passengers and cargo, and have selected Dover with a view to cover Kent and to relieve their traffic between the Thames and Ireland and Scotland. This is the first steam shipping company making long passages which has made Dover a point of call, but other lines are expected to follow when the accommodation of the proposed new port is obtained.

TRADE NOTES FROM THE TYNE, WEAR TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The long-continued strike of the ship-joiners against Mr. Burt's award at last stands in a fair way of being settled, the Mayor of Newcastle having come forward as a mediator, and having secured the assent of the parties concerned to a proposed method of settlement. It may be remembered that the strike arose out of a dispute been the joiners and the shipwrights, as to which should do certain classes of work. The matter was submitted to Mr. Burt, M.P., for adjudication, and that gentleman, after an exhaustive inquiry into the whole case, drew up a list of jobs for each of the disputing parties, indicating at the same time that their respective lists should in future be looked upon as defining the classes of work to which each were entitled. The joiners, though they had consented to Mr. Burt's appointment as arbitrator, and had pledged themselves to accept his decision, subsequently declined to be bound by it, and as soon as the employers attempted to carry the award into effect, which they did in accordance with an announcement previously made, on the 1st of August, the joiners came out on strike. There is the best authority for believing that through this action several important contracts have been lost to the Tyne, and it is an undisputed fact that much valuable work has been sent away from the district, one firm alone having sent work to a foreign port, upon which it was estimated about £6,000 would have had to be spent in wages. The Mayor of Newcastle's proposal for a settlement embodies the appointment of a committee of representative workmen, who shall review the case, and whose decision shall be final. At the time of writing arrangements are being made for the immediate constitution of this committee, and it is probable that the first sitting will take place before the end of the month. It is not considered likely that either of the sections concerned will try to ignore the decision of this committee, as in that case they would have the whole of the other sections of shipyard employés along with the employers against them, and it is believed that they will shrink from placing themselves in such a position of isolation. It is consequently looked upon as certain that the action of this committee will bring about a settlement, and an early resumption of work by those on strike. No sooner does one cause of friction disappear, however, than another presents itself, and thus employers are harassed and hindered in their business, and the trade of the district is irretrievably damaged. The sections of workmen who comprise what is known as the "black squad," and who belong to the Boilermakers' and Ironshipbuilders' Society, are seeking to abolish or restrict overtime and night work, and conferences between the men's representatives and employers have taken place with reference to the matter. The worst feature of this new move by the trade union mentioned is that the employers whose resources, both in capital and working facilities, are the smallest will be most injuriously affected. Even the most powerful firms, however, will find in the proposed restrictive measures a vexatious interference with their business arrangements, besides forming an additional difficulty in negotiating for new contracts. Of course it is quite plain to any one who will give the matter attention, that all measures which encumber the employers in their action as competitors for work must eventually injure the working men themselves more than anyone else, and though the latter do not seem to see this now, they will, if they persist in their harassing policy, most assuredly have the lesson brought home to them. In reference to the state of business in the district, it may be said that since last month no marked change has taken place in any particular instance, though there is generally a better show of work in the yards. Messrs. Armstrong, Mitchell & Co. are proceeding with the initiatory work of two steamers, which are said to be larger than any yet built on the Tyne, and are to be fitted out for the conveyance of passengers as well as cargo. The firm have very little work at their Elswick establishment, the two cruisers that are being built for the Admiralty being now well advanced towards completion. Messrs. Hawthorn, Leslie & Co. are busily finishing a foreign passenger steamer which is moored beside the yard, and are also proceeding with the initiatory work of two or three vessels. Messrs. Stephenson have three vessels, including a Wilson "liner" and an Admiralty cruiser, on the stocks, and it is expected that the latter will be put in the water before the end of this year. Messrs. C. S. Swan & Hunter have all their berths occupied, most of the vessels on the stocks being of a superior class. It is understood that the Palmers' firm have orders for three large boats from a newly-formed company in which some foreign capitalists are interested, and they have a good deal of other work for the mercantile marine, independently of the war vessels, which alone are sufficient to keep a large yard busily going for two or three years. The Tyne Shipbuilding Co. are as usual very busy, having four vessels of large size on the stocks, besides one in the water fitting out. Messrs. Readhead are also quite full of work, and at the comparatively small establishments of Messrs. Ettringham, Messrs. Rennoldson, and Messrs. Hepple the state of business is satisfactory. The repairing yards are, generally speaking, well supplied with work.

Engineering.—In the marine engineering works business continues active, and in most cases vessels are being engined beside the quays. The Mid-Tyne District Committee of the Amalgamated Engineers' Society have at last succeeded in putting a stop to piece work, so far as their own members are concerned, at the Wallsend Slipway Engineering Works, though the system is continued by other sections of workmen who are connected with other societies. Messrs. John Spencer & Sons, of the Newburn Steel Works, have obtained the contract for the steel castings and forgings required in the engines of H.M.S. *Crescent*, which are being constructed by Messrs. John Penn & Sons, Greenwich. Messrs. Spencer have at Newburn a large amount of other work in hand, and at their Ouseburn Works, the machinery is kept going night and day. The engineering department of Messrs. Ernest Scott & Co.'s Works continues extremely busy, the firm having a large number of orders for Admiralty type, feed fire and bilge pumps for cruisers. They have recently secured an order for 40 gun carriages for 6-pounder quick-firing guns, and have also obtained for their brass foundry department several important orders for gun-metal castings, required in the construction of quick-firing guns, and condensers for cruisers now being built on the Tyne. In the electrical department, business is also very brisk, the firm having installations in hand for woollen factories and flour mills in Lancashire and Yorkshire. The large installation for lighting the Co-operative flour mill at Dunston, the order for which was recently obtained, is, we understand, progessing satisfactorily. Messrs. Emerson, Walker & Thompson Brothers, Limited, are exceedingly busy with the manufacture of their patent windlasses and winches, having booked a very large number for delivery during the next six months, and with a view to meeting the increasing demand, are again under the necessity of enlarging their works. The firm have also in hand a number of steel capstans for the Government, and as an instance of variety in steam windlasses, it may be stated that there are now being erected in the shops sizes varying from ½ in. to 2¼ in. cables. The forge department is also full of orders, and at the Winlation branch of the firm's works there is a well-sustained demand for black ironwork, the machinery being kept in full and active operation. Messrs. Donkin & Nichol have received from the Admiralty an order for two ash hoists for the cruiser *Phœbe*, now building in one of Her Majesty's dockyards, and in respect of the same speciality they have received from Messrs. Humphrey, Tennant & Co. an order for eighteen, which are to be distributed as follows: Four each in connection with the engines of the line-of-battleships, *Hood*, *Royal Sovereign*, *Repulse* and *Renown*, and two for the cruiser *Grafton*. In addition to the foregoing, however, the firm have received an order from Messrs. John Penn & Sons, Greenwich, for four such hoists for the engine-rooms of the cruisers *Sappho* and *Scylla*. The firm have a great amount of other work in hand, and all their departments are busy. Mr. James Christie, of the Lord Street Works, is very actively engaged with the manufacture of his improved signal and engine-room lanterns, and is also experiencing a great demand for the copper air cases and brass globe lamps required for all lifeboats under the new regulations of the Board of Trade. An important department of the works is also kept busily going with the manufacture of oil drums, paint kegs, and iron tanks, for which specialities this establishment may be looked upon as the chief local seat of production. Messrs. H. Watson & Sons, of the High Bridge Works, continue to be very fully employed, the demand for their various specialities still continuing to increase. The Combination Metallic Packing Co. are doing an active business, and new orders continue to be received in sufficient numbers to ensure full work over the winter months. Messrs. Carrick & Wardale have a great number of orders for ships' pumps, and are very busy.

THE WEAR.

Shipbuilding.—Though, as stated last month, matters have improved considerably in local shipbuilding, as compared with the state of affairs at midsummer, there are still a good many operatives out of employment, and some of the yards have a decidedly bare appearance. It is understood, however, that Mr. Laing has booked an order for a vessel of the very largest class, for which the frame and beam material is now being received. There are three vessels now on the stocks, one of which will be launched at an early date. Messrs. R. Thompson & Sons have a large vessel ready for putting off the stocks, and the keel for another large one has just been put down. The firm have also a small sailing ship in frame, and have just finished at their graving dock an important repair contract to the s.s. *Iona*. Messrs. Short Brothers continue to be extremely busy, having four vessels on the stocks for local owners, and others in the preparatory stages. Messrs. J. L. Thompson & Sons, having booked a good many orders during the autumn, are now very busy, all the berths being occupied with vessels of a large class. This firm have now in one of the Wear Commissioners' graving docks a large steamer which has to undergo very extensive repairs, the bottom having to be almost wholly renewed. The interior fittings will also have to be in a large measure reconstructed, and several weeks' employment will thus be provided for a large number of hands. The Strand Shipbuilding Co. have but one vessel on the stocks, and the construction of this is proceeding but slowly, the tardiness of steel manufacturers in making deliveries of material being largely accountable for this. The Sunderland Shipbuilding Co. have a handsomely-designed vessel of large size, nearly ready for launching, and another of similar dimensions, in frame, and at Messrs. Bartram & Haswell's yard there are two vessels, also of large size, in the framing and plating stages. Messrs. Doxford's establishment is among the busiest in the district, there being on the stocks three large vessels in various stages of construction, and others are being got ready for laying down. Messrs. Osborne & Graham, Messrs. Priestman, and Messrs. Pickersgill are all fairly busy, the first-named having apparently the largest amount of work in hand. For some time past there have been rumours current with regard to the reopening of certain yards that were closed some years ago, and have since lain idle. At present it would be premature to say anything positive respecting these prospective new departures, though we hope on an early occasion to be able to speak definitely as to whether the rumours have any foundation in fact, or otherwise. Builders of ships' boats are now fairly well employed, and in most cases the boats are being fitted in accordance with the provisions of the new Board of Trade regulations. Messrs. Robson & Son, Monkwearmouth, have a good many orders in hand, and are very busy in both their boat-building and sawmill departments.

Engineering.—At the leading engineering establishments activity is still the rule, the Palmer's Hill Works being perhaps the busiest in the district. Messrs. Doxford are engining a British India Steam Navigation Co.'s vessel, lately launched by them, and at all the other establishments there are vessels receiving their machinery. Mr. A. A. Rickaby, of the Bloomfield Engine Works, is well supplied with orders for his patent piston rod packing and other specialities, and his establishment is kept very busily going. Messrs. John Lynn & Co are among the busiest manufacturers in the district of steam winches and steering gears, and their weekly output is perhaps larger than at any former period. During the past couple of months a good many orders for ships' stern frames, keel pieces, rudders, and engine shafting have been received by forge proprietors, and general activity is now noticeable at these establishments. The foundries are also quite full of work, and the extended resources of the Monk Street Foundry, Monkwearmouth, are found none too great for current requirements. In the anchor and chain shops business is also pretty brisk, and the Monkwearmouth ironworks continue to be well supplied with orders from local shipbuilders. The business of Mr. W. Mills, engineer and boat gear patentee, has undergone a very remarkable expansion since the opening of his works at Bridge Crescent some ten months ago. He is now in daily receipt of orders for his patent boat gear from all parts of the country, most of them coming from the owners of our leading lines of passenger steamers. The popularity of this excellent gear is indeed now well established, and it is pretty certain that Mr. Mills' present manufacturing resources, although extensive, will soon have to be further enlarged to keep pace with the rapidly growing demand for the gear.

The Hartlepools.—Shipbuilding at this centre continues active, repair contracts forming a large part of the work in hand. At Messrs. T. Richardson & Sons' works the following vessels have had their machinery put on board during the months of September and October:—The s.s. *Prinz Willem I.*, owned by Messrs. Koninklyjke West Indische Maildienst, Amsterdam, and intended for their mail service. This ship has engines 22 in., 35 in., 59 in. by 39 in. stroke, with two single-ended boilers of large size, designed for a working pressure of 160 lbs. The s.s. *Capenor*, owned by Messrs. Steel, Young & Co., London, having engines 22½ in., 37 in., and 61 in. by 39 in. stroke, and fitted with two single-ended boilers, working pressure 160 lbs. The s.s. *Hesper*, owned by Messrs. Geo. Horsley & Son, West Hartlepool, and fitted with engines 22 in., 35 in., 59 in. by 39 in. stroke. This ship also has two large boilers of 160 lbs. pressure. The s.s. *Alacrity*, owned by Messrs. Wilson & Corner, of Whitby, having engines 21 in., 35 in., 58 in. by 36 in. stroke, with two single-ended boilers to work to 160 lbs. pressure. The s.s. *Mayumbra*, owned by Messrs. Elder, Dempster & Co., Liverpool, having engines 22½ in., 37 in., 61 in. by 39 in. stroke, and two boilers adapted for a working pressure of 160 lbs. The s.s. *Kate Fawcett*, owned by Messrs. the Atlantic Steam Shipping Co., Sunderland. This vessel was altered from the ordinary compound to the triple-expansion type, and has now three cylinders, working over three cranks, the diameter being 18 in., 30 in., and 57 in., with a stroke of 33 in. One exceptionally large boiler has been fitted, suitable for a working pressure of 160 lbs. The s.s. *Reyneirsz*, owned by Messrs. the Koninklyjke Pakutraart Maatschappy, Amsterdam. The engines of this ship have been built to replace a set which were constructed in Holland, but were destroyed by fire when just completed. As the ship was ready it became a matter of some importance to obtain a set of engines quickly to take their place. Messrs. Richardson & Co. undertook to make a set of engines and boilers, and fit the same on board, making all complete, replacing all shipwork, &c., and have the vessel ready for sea within 12 weeks of the date of order. These engines have now been steamed satisfactorily at the sheers in nine weeks from receipt of order, and there is ample time to complete the arrangements on board ship. The engines are 16½ in., 26½ in., 45 in. by 33 in., stroke, and steam is supplied by one large double-ended boiler, the working pressure being 160 lbs. The dimensions of the vessel are 168 ft. by 27 ft., by 11 ft. 2 in. moulded depth, and the guaranteed speed is 10½ knots. All the above vessels have been fitted with Morison's patent evaporator and feedheater, which is giving complete satisfaction as regards economy and efficiency, wherever used. The following vessels have also had satisfactory trial trips:—On August 27th the s.s. *Baria*, for the Hamburg-Calcutta Line. This fine vessel is fitted with triple engines, having cylinders 24½ in., 38 in., and 64 in. by 48 in. stroke, and has every requirement for efficiency and economy in working. Among other fittings may be mentioned Morison's evaporator, Brown's steam and hydraulic reversing engine, and Weir's duplex feed pumps. The engines throughout are of very massive construction. The boilers are two in number, double-ended, and the working pressure is 160 lbs. During manufacture the engines were superintended by Mr. Pohl, assisted by Mr. Romer and Mr. Buhl. On September 28th the s.s. *Capenor*, owned by Messrs. Steel, Young & Co., London, went on her trial. These engines were, during construction, personally superintended by Mr. Steel, assisted by Mr. Stark. On October 10th the s.s. *Prinz Willem* had her trial, the result being thoroughly satisfactory in all respects, the power being much in excess of the contract. At 75 revolutions per minute the power developed was 1,405, the speed attained being over 13 knots. Mr. Fenenga, of Amsterdam, superintended the construction of both ship and engines. During the last month the usual briskness has been maintained at the Central Marine Engine Works. The splendid passenger steamer, *Umhloti*, built by Messrs. W. Gray & Co., and engined at the Central Works, for Messrs. Bollard, King & Co. for their Natal line of steamers, proceeded on her trial trip to London, and has since left on her first voyage to Natal. This vessel is a sister ship to the s.s. *Umbilo*, built and engined by the same firm, and now making her second voyage. The *Umhloti* is fitted with manganese bronze propeller, and with triple engines somewhat larger than those of the *Umbilo*. The engines gave the greatest satisfaction on the trial trip, running a speed of 12½ knots, and it is calculated that she will run an average of 11½ knots when in actual work. Besides this vessel the s.s. *Elloe*, built for Messrs. Bennett & Co., of Grimsby, and the s.s. *Coatham* for Messrs. English & Smurthwaite, of Middlesbro', have run very successful trial trips. The former vessel has now arrived at Leghorn, and reports that this, her first voyage, has been performed on an extremely low coal consumption. The new forge is fully employed, the weekly output being very large.

Middlesbro'.—Messrs. Raylton Dixon & Co. have secured several important orders lately, and have the berths at both their yards fully occupied. Messrs. Harkess & Sons have lately put down additional machinery in the joiners', smiths', and engineers' shops. They have also greatly improved their slipway, and carried out extensive alterations in the yard, with a view to cheapening production. The firm have a 2,000-ton vessel in the plating stage, and have also a good share of repair work. Messrs. Scraggs & Co. have one vessel on the stocks, but as they have no others in preparation, a slack time in the yard appears to be inevitable. The engine shops are generally well employed, and finished iron manufacturers are kept steadily going.

Stockton.—At the Thornaby Shipbuilding yard there is a fair amount of work in hand, and at other local yards a similar state of affairs may be said to exist. Judging, however, by the low rates of freight, and the great amount of tonnage that is being produced, there appears to be good ground for believing that a serious depression must ere long take place. Since September 19th the following vessels, engined by Messrs. Blair & Co., have had their trial trips:—The s.s. *Wells City*, built by Messrs. Charles Hill & Son, Bristol, for their own fleet, having engines of 160 N.H.P., with cylinders, 21 in., 55 in., and 57 in. by 39 in. stroke. The s.s. *Tynehead*, built by Messrs. Ropner & Son, Stockton, to the order of C. Furness, Esq., of West Hartlepool, having engines of 160 N.H.P., with cylinders, 21 in., 35 in., and 57 in. by 39 in. stroke. Both the above ships' engines are constructed to work at 160 lbs. pressure of steam, and on their trials gave every satisfaction. Messrs. Robt. Roger & Co. are having a large demand for their steering gears and other specialities, and steel works are just now very busy.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—Very great activity exists in connection with the shipbuilding and engineering trades of this district, and the work in hand furnishes plenty of employment for those engaged in this industry. The *Latona*, the first of the armed cruisers built by the Naval Construction and Armaments Co. for the Admiralty, is very nearly completed. The *Empress of India*, the first of the three steamers being built for the Canadian Pacific Railway Co. for the Pacific trade, is being fitted with engines and equipped for sea. It is expected that she will be delivered to her owners at the end of November and that the two sister ships, the *Empress of China* and the *Empress of Japan*, will be launched before the end of the year. The prospect of eight new orders is very good. Mr. Bryce-Douglass, the managing director of the Naval Construction and Armaments Co., Limited, is now returning from Canada, after a brief stay there in connection with an offer from the Naval Constructor to build four high-speed 19-knot steamers to trade between England and Canada. It is understood that the overtures of Mr. Bryce-Douglass have been successful, and doubtless the scheme will be financed on his return home.

Whitehaven.—Messrs. Gilchrist & Co., engineers, of Liverpool, have made a definite offer to the Whitehaven Shipbuilding Co. for the acquirement of their yard. It is said the question is one of price, and it is believed the Liverpool firm will be successful in securing the yard.

Extra Chief Engineers.—At a recent examination held by the Board of Trade for the honorary degree of extra chief engineer in the mercantile marine, Mr. J. Rorison, of Newcastle, Australia, and Mr. J. Duncanson, P. and O. Steam Navigation Co., were successful in obtaining the degree, the first-named gentleman having obtained the first place in the list. Both Mr. Rorison and Mr. Duncanson have been reading with Mr J. Hawthorn, extra chief, principal of the Marine Engineering Academy, 41, East India Road. We also understand that at the late examination for appointment of engineer surveyors to the Board of Trade, that the second place in the list was taken by one of Mr. Hawthorn's students.

THE MERSEY.

THERE is very little that is new to report with regard to the marine engineering industries in this district. Although the outlook is not so unsatisfactory as it was some months back, there is still no very really appreciable improvement in the actual condition of trade. It is true more inquiries are coming forward, but these are mostly at such very low prices that the shipbuilding firms on the Mersey do not care to entertain them, and the only new work taken in hand by shipbuilding yards on the Liverpool side has been a new iron sailing ship, laid down by Messrs. W. H. Potter & Sons, and this is not an actual order, but is being built for themselves. With this exception the shipbuilding yards are simply going on working off their contracts, and are taking practically no new work at all. On the Birkenhead side, Messrs. Laird Bros. are, as previously reported, fully engaged, and have work in hand to keep them actively employed for some time to come, but this is chiefly upon contracts for the British and foreign Governments, although they have, as announced, last month secured one or two new orders for steamers for the Great Western Railway Co. Rapid progress is being made with the line-of-battle ship the *Royal Oak*, which they have in hand for the British Government, and they have just completed most successful official trials with the two torpedo gunboats *Almirante Lynch* and *Almirante Condell* they have built for the Chilian Government, details of which will be found in another column. Marine engineers are in much the same position as last reported. They are gradually working off the orders they have in hand, but are booking no new work of any importance. Taking the outlook of the shipbuilding trade generally it is still not of a very hopeful character. Dividing it generally into three departments, firstly, Government work; secondly, the building of liners for the great passenger steamship companies; and thirdly, the building of general trading ships, which go under the term of "tramps," it may be said that in the first two departments there is a fair amount of work doing. The Government have placed out considerable orders, and have further work to give, whilst the building of the large passenger liners is a necessity to replace the constant wear and tear and to keep up with the increasing competition for quick passages. These two branches, however, are practically only a small proportion of the general shipbuilding trade, and outside these there is very little work coming forward in the building of steamers and ships for general trade requirements. With regard to labour questions, there is still a very uneasy, unsettled feeling, and where shipbuilding yards are at all busy they have to be constantly making concessions of some sort or another to pacify the repeated demands which are put forward by the men. This, no doubt, is a considerable factor in preventing shipbuilders from entertaining a good many of the inquiries that have recently been coming forward, but which otherwise, notwithstanding the very low prices at which work can alone be secured, they might have been disposed to undertake if they could have been assured of something like a reasonable attitude on the part of their workmen. In the general engineering industries activity is being well maintained, and there is no appreciable increase in the number of out-of-work members on the books of the trades' unions organizations. This, of course, tends to strengthen the position of the men, and to make them less disposed to entertain the consideration of any concession in the rates of wages, however much this may be necessary to enable employers to secure new work. It can therefore scarcely be expected that until some general depression, of which there is no immediate prospect, comes over the engineering industries, there will be much probability of bringing about any material reduction upon the present high rate of wages now ruling throughout all branches of trade.

In both the iron and the steel trades the course of the market during the past month has been the most perplexing that could well be imagined. Generally it was anticipated that should the dispute with the blast furnacemen on the Clyde result in the damping down and blowing out of the furnaces in Scotland, there would be necessarily a strong upward movement in prices. In the place of this, immediately following the actual commencement of the dispute, there has been a steady downward movement in prices, which has altogether unsettled the market and created so general a feeling of want of confidence in the future that business has been completely checked. Consumers have confined their purchases to merest hand-to-mouth requirements, and as in most cases they are tolerably well covered over the remainder of the year, the orders coming upon the market, have been extremely small in weight. In outside brands of pig-iron offering in these market prices have receded fully 3s. per ton since the commencement of the strike on the Clyde, whilst in local and district brands there has also been an easing down upon previous rates. With so very little doing in pig-iron, makers' quotations are practically just now of no very great value, and, to a considerable extent, are scarcely more than nominal. This applies especially to forge qualities of iron, users of which are practically buying nothing for the present, and going on simply with their existing contracts which will generally carry them over the remainder of the year. In fact, in face of the absence of any improvement in finished iron, they complain that they are quite unable to pay the current prices quoted for the raw material, and until trade is in a more satisfactory condition, either as regards an improvement in finished iron or in more favourable conditions as to which they can buy the raw material, they will have to hold back from entering into further contracts for pig-iron. Lancashire makers quote about 50s. to 51s. 6d. less 2½ for forge and foundry delivered equal to Manchester, but it is only in the immediate neighbourhood of their own works where they have an advantage in rates that they are able to sell on the basis of these figures. In Lincolnshire, forge numbers are nominally quoted at about 50s., less 2½ delivered, but this figure is quite out of the market, and makers are turning their attention more to the production of foundry qualities, upon which they have eased down somewhat in their prices with a view of securing orders. No. 3 foundry, Lincolnshire, being now offered at about 52s. to 52s. 6d., less 2½ delivered equal to Manchester. For Derbyshire iron, quotations vary considerably, according to brand, some of the cheapest forge and foundry descriptions being obtainable at 50s. to 52s., whilst the best foundry qualities are firm at 56s. to 56s. 6d., less 2½ delivered. Outside brands coming into this market are governed so much by the fluctuations in warrants at Glasgow and Middlesbro', that there are no really fixed prices; Eglinton may, however, be said to average about 59s. to 59s. 6d., and good foundry Middlesbro' from 56s. 4d. to 57s. 4d. net cash, delivered equal to Manchester.

In the steel trade business continues only of very limited dimensions either as regards raw or manufactured material. In hematites there has been very little doing, and good foundry qualities can be readily bought at 65s., less 2½ delivered here, although 2s. above this is quoted in some instances. Steel plates suitable for boiler-making purposes still meet with very little inquiry, notwithstanding that boiler-makers throughout this district are all very full of orders, and report no scarcity of new work coming forward. Local makers quote about £8 5s. for good steel boiler plates, delivered to consumers in this district, but to secure orders they would, no doubt, be willing to accept 2s. 6d. per ton under this figure. Steel boiler plates from other districts are quoted £8 7s. 6d. to £8 10s. per ton, delivered here. Steel ship plates also meet with only the most restricted inquiry, and although prices have advanced upon the very low figures which were taken a month ago, this is not due to any increased demand so far as this district is concerned. For delivery ex-steamer Liverpool steel ship plates are obtainable at about £7 7s. 6d. to £7 10s. per ton, which is something like 10s. above the figures at which orders have been placed quite recently, and steel angles average about £7 5s. per ton delivered.

In the metal market there has been a decidedly increased weight of business coming forward during the past month, and although list rates have not been advanced officially, manufacturers are all so pressed with work that in some instances they are unable to undertake new orders for anything like early delivery, and there is a decidedly hardening tendency in the market. For delivery equal to Liverpool or Manchester, quotations are about as under:—Seamless brass tubes, 8¼d. per lb.; seamless surface condenser tubes, 9¾d. per lb.; S.D. copper tubes, 9¼d.; brazed copper tubes, 9¼.; S.D. brass machine tubes, 8½d.; yellow metal condenser plates (rectangular) 7d. per lb.; brass wire, 7½d. per lb.; copper wire, 9d. per lb.; rolled brass, 7¼d. per lb.; sheet brass, 8¼d. to 8½d.; yellow metal sheathing, nails and spikes, 8½d.; copper ingots, £69 per ton; and copper sheets, £72 per ton.

The timber trade remains in a more or less depressed condition. Although the aggregate import of both timber and deals continues less than during the corresponding period of last year, some of the leading articles, stimulated by the present low freights, have been imported too freely, whilst the deliveries although fair have not improved. The result is that stores have accumulated and generally are much too heavy for present requirements. So far as values are concerned, there has been no improvement, but in some articles a decline, and the want of confidence still existing makes business most difficult.

The coal trade continues in an inanimate condition, considering the season of the year, and supplies are plentiful in the market with prices scarcely firm at list rates. For shipment, there has been a fair amount of business done during the past month, but stormy weather recently has greatly interfered with securing vessels, and a considerable amount of steam coal has in consequence been thrown temporarily upon the market. For good ordinary qualities of steam coal delivered at the ports on the Mersey 10s. 6d. to 10s. 9d. per ton may be taken as about the average prices, although 3d. to 6d. per ton above these figures is being quoted in some instances, but where higher prices are obtained it is only for special qualities of coal.

WELSH NOTES.

THE trade of the Bute Docks, Cardiff, continues satisfactory. The coal exports for the past month are above the average. The import trade continues fairly satisfactory. At present the port is free from any labour troubles. The condition of the coal and other kindred trades is unaltered. For steam coal there is a steady demand at the following prices:—Best qualities, 14s. 9d. to 15s.; good dry coals, 14s. to 14s. 3d.; and inferior sorts, 12s. 9d. to 13s. 3d. Small steam at 7s., while patent fuel remained firm at 14s. to 14s. 6d. per ton. In the house-coal trade a strong demand prevailed for No. 3 Rhondda, as much as 12s. 6d. having been paid for small parcels. The ruling quotation for large, however, was 14s. 3d., and at this figure the market closed firm. No. 2 Rhondda, notwithstanding the near approach to cold weather, was easier, 12s. 6d. appearing to be the current selling price. Through was in demand at 10s. 6d., and small at 7s. 3d. to 7s. 6d. per ton. The coke trade was active at 23s., and 21s. was still the quoted price for foundry and furnace qualities respectively. Iron ore was firm at 15s. to 15s. 3d. per ton, and the improvement previously reported in the pitwood trade has been maintained since. 16s. 9d. to 17s. was freely quoted for good timber. Outward freight market steam chartering was moderately active.

The new works of the Dowlais Iron Co. at Cardiff are approaching completion. They are arranged in three divisions, one for the manufacture of pig-iron, a second for steel, and a third for large steel plates for shipbuilding purposes.

Although the import trade at Swansea has been quiet, the export trade has been active. The shipments of coal, patent fuel, and tinplates show a substantial improvement. The prices of tinplates continue to move upwards. The proprietor of the Upper Forest Works, one of the largest makers in the trade, who is now in America, has given his opinion to the *Pittsburg Times* that Welsh makers, notwithstanding the extra duty, will be able to put plates in America after July at a fair profit. The metal market continues in an unsettled state.

A railway is being promoted which, if carried out, will bring the Rhondda Valley into direct communication with Swansea. The scheme proposes to divert traffic from the present Rhondda and Swansea Bay Railway, at a point near the Pontrhydyfen Station on that line, to the South Wales Mineral Railway, which can be reached by means of a short tunnel. The line, if carried out, will be constructed down the Eaglesbush Valley; and if the necessary powers can be obtained, the Neath will be crossed at a point between the Melyncrythan Chemical Works and the Great Western sheds. A junction will thus be effected with the Great Western low level to Swansea.

The monthly meeting of the Swansea Harbour Trust was held on Monday, October 20th, Mr. G. B. Strick presiding. Mr. Francis stated that the accounts for the past month were satisfactory, the rates on shipping and goods being £5,335, against £3,973 in the corresponding month of last year, and an average of £4,026 for the two preceding months. The total revenue for the year was the largest ever recorded, notwithstanding the abolition of the bridge tolls.

The first meeting of the Gloucester Harbour Board has been held. Mr. R. G. Foster was appointed chairman, and Mr. G. W. Keeling vice-chairman. The duties of the Board commence January 1st.

BELFAST TRADE NOTES.

THE shipbuilding outlook for the coming winter is now considerably brighter than it was a few months ago. Since then a good many orders have been booked by the different yards, and the stocks will shortly be again fully occupied. These orders, however, have been taken at a very low rate, and will merely serve to keep the staff of hands employed, and cannot yet be looked upon as a sign of improvement in the shipping trade. There are still several vessels of large tonnage which can be launched before the end of the year, and it is expected that the output will not fall far short of that of last year. Wages are still on the same basis as six months ago, and no change either way is probable for some time.

The engineers and boilermakers are all at present fully occupied, and a fair number of orders are in hand. Messrs. Harland & Wolff, Limited, have obtained more ground for the extension of their boiler shop, and will commence operations on the 1st November. It is expected that Messrs Workman, Clark, & Co., Limited, will also then commence the erection of their engine and boiler works, for which they have obtained a very suitable site of about ten acres.

LEITH NOTES.

THE shipbuilding and engineering trades in Leith during the past month have been very quiet, the endeavour on the part of the men being to make the work on hand last as long as possible. In Messrs. Ramage & Ferguson's yard the men went out on strike at the beginning of the month, and remained out for a full fortnight, the subject of dispute being the winter hours, which necessitate the men working till a quarter to two on Saturday, to make up the 54 hours. Work was resumed on the 16th inst. at the employers' terms.

No launches have occurred during the month, and no new orders have been booked.

The directors of the North British Railway Company are having plans prepared for the extension of the dock accommodation at Methil, Fifeshire, and for the deepening of the channel. The development of the coal trade at this port has led to this important step being taken by the directors.

The proposal to convert the loading slip belonging to the North British Railway Company, and rendered useless by the opening of the Forth Bridge, into a patent slip for the repairing of vessels; formed a subject of discussion at the monthly meeting of the Burntisland Harbour Commissioners. Mr. Walker, of the North British Railway Company, stated that the company would be willing to give the site and adjoining grounds for the sum of £10 a year, on condition that the ground be given over to the company whenever they might require it for railway purposes. Nothing definite was arranged on the subject.

The Burntisland harbour revenue shows a decrease of £331 2s. 4d., as compared with the corresponding month last year. A strike occurred on the 15th amongst the labourers employed in discharging the Leith s.s. *Moravia*, in Dundee, owing to the steamer being manned by "blacklegs." Non-unionist men were at once employed, and the steamer left in due course without any delay whatever being incurred.

A Weather Forecasting Plant.—At the recent exhibition of Mining and Metallurgical Appliances held at the Crystal Palace, Mr. I. F. Nowack, at stand 35 in the west corridor, showed specimens of "The Weather Plant" (*Abrus Precatorius*). It is well known that there are many plants which have the capacity of indicating certain changes of the weather just before they occur, and Mr. Nowack's idea is that by a proper and systematic study of these, due warning could be given which might be the means of preventing disasters both at sea and on land. To this end, he advocates the establishment of a meteorological station where his investigations might reach perfection, and from which might issue warnings from the indications of the plants. From a scientific point of view it would be interesting to have Mr. Nowack's theories thoroughly tested and examined, and it will be a most important acquisition if those theories are found to be capable of practical results. Along with his exhibits he showed the official awards he has received, and also a diamond pin presented to him by the Emperor of Austria, and the gold medal of the Vienna Jubilee Exhibition, 1888, given to him in recognition of the interesting results of his investigations in this direction.

Dock Improvement at Gloucester.—The directors of the Gloucester and Sharpness Dock Co. have adopted a scheme for the improvement of Gloucester Docks by the construction of a new dock on the Monkmeadon property, which will practically double the present dock area. The new dock is to be six acres in extent, and will be situate on the western side of the Gloucester and Berkeley Canal, through which all vessels bound for Gloucester have to pass. The property is in possession of the Dock Co., but has not hitherto been utilized for trade purposes. A large timber-trading firm has already secured seven acres of the land adjoining the proposed new dock for storage purposes, and the new dock will considerably relieve the congestion from which the port has suffered through lack of adequate wharfage and storage accommodation.

A New Submarine Boat.—An Italian engineer, Signor Balzamello, has invented a submarine boat. The principal feature of the vessel is that it is spherical. In the interior is room for the machinery, by which it is possible to propel, steer, sink, and raise to the surface again with perfect ease and simplicity this *palla nautica* (nautical ball), as it is called in Italian. It is, moreover, fitted with lenses, by which those in the interior can not only guide their way, but also see the submerged articles that is desired to bring to the surface. For this purpose, the nautical ball is furnished with grapnels and hooks on the outside, which can be manipulated from the interior. Both on the surface and under the sea it can be steered either in a direct line or turned with perfect ease.

Literary Announcements.—A very important new work, entitled *The Mechanical Engineers' Office Book for Machine and Boiler Construction*, will shortly be issued by Messrs. Crosby Lockwood & Son, London. The work is written by Mr. Nelson Foley, and illustrated by fifty specially-prepared plates, in large folio. The same publishers also announce *The Analysis and Valuation of Fuel*, Solid, liquid, and gaseous; a manual for chemists and engineers. By H. J. Phillips, F.C.S. Crown 8vo. *Asbestos:* Its properties, occurrence, and uses. By R. H. Jones. Illustrated with collotype plates. Crown 8vo. *Electric Light:* Its production and use. By J. W. Urquhart. Fourth edition. Revised and extended. Crown 8vo. Also the following new edition in Weal's rudimentary scientific series:—*Portland Cement for Users.* By Henry Faija, M.Inst.C.E. Third edition. Corrected and enlarged.

Rapid Passages.—The White Star liner *Teutonic*, which passed Sandy Hook on Wednesday, October 15th, at 7.51 a.m., arrived off Roches Point at 12.45 p.m., October 15th, accomplishing the passage in five days 23 hours 51 minutes. The *City of New York* was timed passing Sandy Hook at 7.35 p.m. on October 21st, and reached Roches Point October 15th, at 2.32 p.m., a passage of six days two hours 27 minutes. The English mails brought by the *Teutonic* were despatched from Queenstown by the 1.40 p.m. mail train, and delivered next morning at 7 o'clock in London, an unprecedented feat; whilst those of the Inman liner were despatched from Queenstown by a special train at 4.20 p.m. to Dublin. A special boat will carry them, on arrival there, to Holyhead, where the London and North-Western Railway will start another special for their conveyance to London, by which means letters posted in New York Wednesday, October 10th, were delivered at an early hour in the City of London on the following Wednesday morning, a feat which has never before been accomplished.

The Manchester Association of Engineers.—This association opened its 1890-1 session by a social gathering held in the Grand Hotel, Manchester, on October 11th, which was largely attended and proved a complete success. This association was established in Manchester, in 1856, for the purpose of bringing together those engaged in the direction and superintendence of engineering works, for mutual improvement, increase of acquaintance, and for promoting more frequent exchange of opinions on interesting questions constantly arising from the progressive nature of the mechanical trades, as well as for bringing under the notice of members any subject or invention which, from its novelty, usefulness, or otherwise might be instructive or interesting. It was further aimed that the association should grant pecuniary assistance to such of its members as might require it, by providing superannuation allowances, and rendering aid to members who, through physical incapacity or accident may be unable to follow their usual employment, and to assist members who are unemployed in procuring suitable situations. An interesting syllabus for the session now entered upon has been published, and we observe that the subjects embraced in the papers proposed to be read are of especial interest to engineers, marine and otherwise, as well as to electricians.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Bamboro.—On September 20th a steel schooner-rigged steamer, of 2,004 tons, was launched at Newcastle, owned by Messrs. J. E. Bowser, Ormston & Co., Newcastle.

Ching Ping.—On September 25th there was launched a very handsome steel screw passenger steamer, built by the Blyth Shipbuilding Co., Limited, at their Shipbuilding and Graving Dock Works, at Blyth. The vessel, which is 223 ft. long, is fitted with teak decks and elaborate teak deck-house for captain and officers; and accommodation for a large number of passengers is provided in a spacious saloon, which will be tastefully fitted up, whilst the crew have comfortable berths in a topgallant forecastle. The vessel, which was named the *Ching Ping*, is equipped with all the most recent improvements in deck machinery, including Napier's patent steam windlass and capstan, Donkin & Nichol's steam steering gear, John Smith & Son's steam winches, &c. Triple-expansion engines will be fitted by Mr. M. Pratt, of Huddersfield. The christening ceremony was performed by Miss Moore, of London. The *Ching Ping* has been built to the order of Mr. John White, of London, and during construction has been superintended by Mr. J. G. Walton, of London, who has also looked after the building of the engines. A sister ship to the *Ching Ping* is in a forward state of construction.

Mayumba.—On September 26th there was launched from th Cleveland Dockyard of Messrs. Sir Raylton Dixon & Co., Middlesbro', a steel screw steamer for Messrs. Elder, Dempster & Co., of Liverpool. This vessel is built on the web-frame principle, with long raised quarter-deck and partial awning-deck and is of the following dimensions:—Length, over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in., with a deadweight capacity of about 3,600 tons. She has wood-sheathed decks and all accommodation for officers and men above deck in well-ventilated houses for the West African trade. Her engines will be fitted by Messrs. T. Richardson & Sons, of Hartlepool, having cylinders 22½ in., 37 in., and 61 in. by 39 in. stroke. On leaving the ways the vessel was named *Mayumba* by Mrs. Taylor, wife of Capt. Taylor, who has been appointed to command the vessel. As an instance of what can be done at the Cleveland Dockyard, in way of rapid construction, it may be mentioned that this vessel was launched from the same stocks on which another steamer of similar size was standing so lately as the 5th of July last. This vessel is the sixteenth launched by Sir Raylton Dixon & Co. this year.

Ipsden.—On September 27th Messrs. W. Gray & Co., Limited, launched the fine steel screw steamer *Ipsden*. She is of the following dimensions, viz.:—Length, over all, 270 ft.; breadth, 36 ft. 6 in.; depth, 19 ft. 5 in., and is built to the order of Messrs. John Wood & Co., West Hartlepool. She will take Lloyd's highest class, and is of the well-decked type, with a long raised quarter-deck, having saloon and cabins aft, a long bridge of extra strength, and topgallant forecastle with accommodation for crew. The hull is built on the web-frame principle, with double bottom under each hold for water ballast. She will be schooner-rigged. The boats will be carried on beams overhead, and a complete equipment provided for general trading, including large donkey boiler, four steam winches, steam steering gear, &c. Fine triple-expansion engines, having cylinders 19 in., 30½ in. and 51 in. diameter, with a 36 in. stroke of piston, and two steel boilers to work at 150 lbs. pressure per square inch, are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited. The ceremony of christening the ship *Ipsden* was gracefully performed by Miss Jinnie Wood, daughter of the owner. Mr. Craig has superintended the construction of the ship and engines on behalf of the owners, and amongst those present at the launch was Mr. James Wood, representing the owners.

Gyda.—On September 27th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Bill-Quay-on-Tyne, a steel screw steamer, built to the order of Mr. Harald Isachsen, of Grimstad, Norway. The principal dimensions are:—Length, 237 ft.; beam, 33 ft.; depth, moulded, 18 ft.; with a deadweight carrying capacity of 1.800 tons. The vessel is constructed on the raised quarter-deck system, with cellular double bottom all fore and aft, and will take the highest class at Lloyd's, and also Norwegian Veritas. The cabins are arranged in a large house on the bridge deck; accommodation is provided for engineers and officers under after end of bridge, and for the crew in topgallant forecastle. Steam and hand-steering gear are fitted on the flying-bridge, and hand-gear in the wheel-house aft, by Emerson, Walker & Thompson Bros., Limited, patent horizontal direct steam windlass. During construction the vessel has been superintended by Captain Andersen, of Grimstad. The engines have also been built to Lloyd's and Norwegian Veritas requirements, by the North Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, and are on the triple-expansion principle, having cylinders 17 in., 28 in., and 46 in., with 33 in. stroke, capable of indicating 700 H.P., and propelling the vessel at a speed of 9½ knots loaded. The vessel was named the *Gyda* by Miss Mathilde Nyguist, of Grimstad.

Hedwig Woermann.—On September 27th Messrs. Wigham Richardson & Co. launched from their Neptune Shipyard, Low Walker, a finely-modelled screw steamer, which has been built to the order of the Afrikanische Dampfschiffs Actien Gesellschaft, Woermann Line, of Hamburg, who intend it to form part of their fleet for their African service. She is a steel vessel, 230 ft. in length by 23 ft. beam by 15 ft. 9 ft. in depth, and will take the highest class in the Bureau Veritas classification. She will be provided with triple-expansion engines which, with the boilers, are also being constructed by Messrs. Wigham Richardson & Co. The ship will likewise be furnished with a powerful steam windlass, steam steering gear, and steam winches. The vessel was named the *Hedwig Woermann*, the ceremony being performed by Miss R. A. Colorado. The construction of the hull, engines and boilers is proceeding under the superintendence of Mr. Robert Pohl, of Hamburg.

Obidense.—On September 27th a steel schooner-rigged steamer of 2,100 tons was launched at Liverpool; owned by Messrs. Singlehurst & Co., of Liverpool.

Feronia.—On September 29th Messrs. Ropner & Son launched at Stockton a steel screw steamer of the following dimensions:—Length, over all, 325 ft. 6 in.; breath, 40 ft. 6 in.; and depth, moulded, 23 ft. 7 in. This steamer has been built under special survey to class 100 A1 at Lloyd's, to the order of Messrs. Gladstone & Cornforth, West Hartlepool, and will carry 4,500 tons cargo and fuel on Lloyd's summer freeboard. She is fitted with patent direct-acting steam windlass by Emerson, Walker & Thompson Bros., Limited. Her engines are by Messrs. Blair & Co., Limited, of 1,100 H.P., with two steel boilers working at 160 lbs. She was named *Feronia*.

Franklin.—On September 30th Messrs. Sir Raylton Dixon & Co. launched from their No. 2 Dockyard a steel screw steamer of the following dimensions:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a carrying capacity of about 3,300 tons. This vessel, which has been built to the order of Messrs. Arthur Holland & Co., of London, being the ninth vessel launched for them by Messrs. Dixon within the last six months, is constructed on the web-frame principle, with poop, raised quarter-deck, and topgallant forecastle. Her engines will be fitted by the North-Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, and will be fitted with Emerson, Walker & Co's steam windlass. On leaving the ways the vessel was named the *Franklin*.

Knight of St. George.—On September 30th there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Co., Limited, a steel screw steamer of the following dimensions:—Length over all, 425 ft.; length, between perpendiculars, 405 ft.; breadth, moulded, 47 ft. 6 in.; depth, moulded, 30 ft. 2 in. She is built on the three-deck type, the upper and main decks being of steel right fore and aft, the former being sheathed with pine. There is a long bridge amidships, covering all the engine and boiler space, and containing accommodation for the officers and engineers. A poop aft provides accommodation for a native crew, and there is an open topgallant forecastle forward. A double bottom for water ballast, on the cellular system, is fitted all fore and aft; also a complete set of shifting boards and grain hatches in the 'tween decks, suitable for grain cargoes. Emerson & Walker's direct acting steam windlass is fitted up forward, and Harrison's steam steering gear amidship, the rudder being provided with patent steel quadrants and side spring buffers. The vessel has all the latest improvements, including an instalment of the electric light by Messrs. Holmes, of Newcastle, and Utley's patent ventilator. The vessel has been built under special survey to class 100 A1 at Lloyd's, for Messrs. Greenshields, Cowie & Co., of Liverpool, and will carry 7,000 tons deadweight. During construction the hull was personally superintended by Mr. Thomas Muir, of Liverpool, and the engines by Mr. Goodwin, also of Liverpool. The vessel was christened the *Knight of St. George* by Miss Mary Price, daughter of the general manager of the builders' company. This is the sixth vessel which Palmer's Co. have built for the Knight line.

Manx Maid.—On September 30th the *Manx Maid*, a small steamer intended for coasting traffic between English, Scotch, and Irish ports, was launched at Ramsey, Isle of Man.

Keemun.—On September 30th Messrs. J. L. Thompson & Sons launched at Sunderland a screw steamer of over 5,000 tons measurement. This vessel has been built to the order of the China Shippers' Mutual Steam Navigation Co., Limited, London, and is intended for the China tea service. The vessel is of the following dimensions, viz.:—Length, over all, 380 ft.; 41 ft. 6 in. beam; and 25 ft. 3 in. depth of hold. The engines are of the triple-expansion type, having three cranks. The vessel was named *Keemun*.

Dunfermline.—On September 30th Messrs. W. H. Potter & Sons launched at Queen's Dock, Liverpool, a large steel sailing vessel, of which the following are outline particulars:—Length, 310 ft.; breadth, 45 ft.; depth of hold, 25 ft.; tonnage net register 2,800 tons, deadweight capacity 4,300 tons. The vessel, which was named *Dunfermline*, has been built to the order of Messrs. Macvicar, Marshall & Co., of Liverpool.

Janet Storm.—On September 30th a wooden schooner was launched at Yarmoutb; owned by Mr. John Storm.

Saint Hnbert.—On September 30th a steel schooner-rigged steamer, of 2,968 tons, was launched at Sunderland, owned by the British and Foreign Steamship Co., Limited, Liverpool.

Paulo Affonso.—On September 30th a steel steamer was launched at Preston; owned by Antonio Ulyses de Carvalbo, of Rio Janeiro.

Martaban.—On October 2nd an iron steam yawl, of 148 tons, was launched at Hull; owned by Messrs. Beeching & Co., of Hull.

Madero.—On October 2nd an iron schooner-rigged steamer, of 336 tons, named the *Madero*, was launched at Sudbrook; owned by the executors of the late Mr. T. A. Walker, of London.

Fultala.—On October 14th this vessel was launched by Messrs. Wm. Doxford & Sons, of Pallion. She is built to the order of the British India Steam Navigation Co., Limited, of London and Glasgow, and the principal dimensions are:—Length, 380 ft.; breadth, 48 ft.; depth, 29 ft. 3 in.; and she is fitted with horizontal steam windlass with Warper on forecastle deck by Emerson, Walker & Co. This vessel is a duplicate of the *Fazilka* just built and sent to sea by Messrs. Doxford for the same company, who, it will be remembered, are the owners of the large ship *Golconda*, also built by Messrs. Doxford. The christening ceremony was gracefully performed by Miss Aline Doxford.

Azima.—On October 15th Messrs. Craig, Taylor & Co. launched from their Thornaby shipbuilding yard, Stockton-on-Tees, a steel screw steamer which has been purchased by Messrs. W. H. Loveridge & Co., West Hartlepool. Her dimensions are as follows:—289 ft. by 37 ft. 9 in. by 21 ft. 9 in., moulded. She is built on the web frame and cellular bottom principle, with long bridge, long raised quarter-deck, short well, and top gallant forecastle. She has steam windlass, by Emerson, Walker & Thompson Bros., Limited. Outfit of winches by Robert Roger & Co., steam steering gear, and all modern improvements so as to admit of rapid loading and discharging. Her engines, on the triple-expansion surface condensing description, are by Messrs. Westgartb, English & Co., Middlesbro', with cylinders 21 in., 34 in., 56 in. by 39 in. stroke. Two large boilers 160 lbs. pressure. As the vessel left the ways she was gracefully christened the *Azima* by Miss Gertrude Watson, of Maylands, Stockton-on-Tees.

Oaklands.—On October 15th the fine steel screw steamer *Oaklands*, built by Messrs W. Gray & Co., Limited, for Messrs. Hardy, Wilson & Co., of Hartlepool, was launched. She is the eleventh vessel these well-known builders have launched for the same owners. She takes Lloyd's highest class and will carry about 2,800 tons deadweight, the dimensions being:—Length, over-all, 210 ft.; breadth, 37 ft.; depth, 20 ft. She has a poop containing a handsome saloon, state-room and captain and officers' rooms; long raised quarter-deck, long bridge in the after end of which the engineers' rooms are fitted, and top-gallant forecastle, having accommodation for the sailors and firemen. The hull is built on the web-frame system, with double bottom under each hold, and the equipment will be of the most modern description, including steam winches, steam steering gear amidships, screw gear aft, large donkey boiler, Emerson, Walker & Co.'s patent windlass, shifting boards throughout, boats on beams, &c. After being gracefully christened by Miss Edith Wilson, daughter of one of the managing owners, the vessel glided safely into the water. She will shortly go under the large sheerlegs at the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, to receive her fine triple-expansion engines of 800 H.P., and two large steel boilers to work at 160 lbs. pressure per square inch. The hull and machinery have been superintended during construction by Mr. J. Maddison, on behalf of the owners.

Asp.—On October 15th Messrs. Richard and Henry Green launched from their yard at Blackwall a steam steel water tank, fire-float and tug vessel, named the *Asp*, built to the order of the Admiralty. The dimensions are:—Length, 115 ft.; breadth, 21 ft.; depth, moulded, 10 ft. Besides being used as a tug, she will carry 100 tons of fresh water for supplying the ironclads, and has a powerful fire-engine which will discharge water to the height of 100 ft. at the rate of 200 tons per hour. The engines, which are of the triple-expansion type, are being supplied by Messrs. Hawthorns & Co., Leith: cylinders, 11½ in., 18 in., and 30 in., to indicate 300 H.P. Immediately after being launched she was towed to Blackwall to receive her machinery. It is understood that this vessel is the first of a number of this exceedingly useful type which it is the intention of the Government to build. Among the company were W. H. White, Esq., F.R.S., assistant controller, and James Dnnn, Esq., chief controller to the Admiralty.

Itbamo.—On October 15th there was launched by Messrs. John Priestman & Co., Snnderland, a steel steamer of the following dimensions:—Length, 300 ft.; breadth, extreme, 39 ft.; depth, moulded, 21 ft. 3 in. She has been built to the order of the Pinkney Steamship Co., Limited, and will carry about 3,600 tons. The engines, which are being supplied by Messrs. Wm. Allan & Co., are of the triple-expansion type, of about 1,100 I.H.P. The ship was named the *Ithamo*.

Seal.—On October 16th Messrs. Sir Raylton Dixon & Co. launched from their No. 2 dockyard, Middlesbro', a steam trawler, which has been built to the order of Mr. G. Alderson-Smith, of Scarborough. This vessel is of the following dimensions:—Length, over all, 106 ft. 6 in.; breadth, 20 ft. 4¾ in.; depth, moulded, 11 ft. 11 in. She is fitted with cabin aft, also accommodation forward, hold fitted for fish and ice, and is provided throughout with all modern appliances for trawling, including powerful steam winch—Good & Menzie's patent. Her machinery will be fitted by the Vulcan Ironworks Co., Limited, Hull, having cylinders 17½ in. and 34 in by 24 in. On leaving the ways she was named *Seal*.

LAUNCHES—Scotch.

Pebble.—On September 18th Messrs. Scott & Co., Bowling, launched from their shipbuilding yard a screw steamer of the following dimensions:—Length, 165 ft.; breadth, 26 ft.; depth, 12 ft. 2 in.; built to the order of William Robertson, Esq., 15, Gordon Street, Glasgow, and intended for his general coasting trade. Triple-expansion engines will be supplied by Messrs. Muir & Houston, Portman Street, Glasgow. On moving down the ways the vessel was named *Pebble* by Miss M'Pherson, Yoker, niece of the owner.

Cambrian King.—On September 29th Messrs. Rnssell & Co. launched from their Bay Street yard, Port-Glasgow, a three-masted steel sailing ship named *Cambrian King*, of the following dimensions:—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft. of 1,700 tons net register, to carry 2,800 tons on Lloyd's freeboard. She is fitted with Emerson, Walker & Co's. patent windlass. This vessel is to the order of Messrs. Thomas Williams & Co., Liverpool, and was built under the superintendence of Captain David Elias.

Pentakota.—On September 30th Messrs. A. & J. Inglis launched from their shipbuilding yard at Pointhonse the *Pentakota*, a steel screw steamer of 3,450 tons gross, built to the order of the British India Steam Navigation Co. The vessel is 360 ft. long by 42 broad by 29 ft. deep. She will be fitted by the builders with triple-expansion engines to indicate 2,700 H.P.

North Cape.—On September 30th a screw steamer was launched from the shipbuilding yard of Messrs. John Duthie, Sons & Co., Aberdeen. Dimensions:—Length, 95 ft.; breadth, 19½ ft.; depth of hold, 10 ft. She was named the *North Cape*, and has been built to the order of Mr. William Pyper and others for the travelling business.

Faranaca.—On October 1st there was launched from the yard of Messrs. Murdoch & Murray, at Port-Glasgow, a twin screw steamer, named the *Faranaca*. The vessel is built of steel, and is intended for passenger and cargo trading on the River Amazon. After the launch the vessel was taken to Glasgow, where she will be fitted by Mr. William Kemp, Govan, with two sets of triple-expansion engines. The vessel is to the order of Jose R. d'Oliveira.

Comliebank.—On October 2nd Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, this four-masted sailing barque for Messrs. Andrew Weir & Co., Glasgow. Her dimensions are:—Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 3 in.; 2,200 tons net register; to carry 3,600 tons on Lloyd's freeboard. She is fitted up forward with Emerson, Walker & Co.'s patent windlass.

Guarany.—On October 4th a steel steam smack was launched at Greenock, owned by the Amazon Steam Navigation Co., Limited, of Para.

Steel Screw Steamer.—On October 6th Messrs. Russell & Co., shipbuilders, Greenock, launched from their Greenock yard a steel screw steamer of 3,000 tons gross, and of the following dimensions:—Length, 300 ft.; breadth, 41 ft.; and depth, 22 ft. 2 in. She will be masted at Greenock, and afterwards proceed to Glasgow for engines and machinery by Messrs. James Howden & Co.

William Bell and **John Milne.**—On Saturday forenoon, October 11th, two hopper barges, built to the order of the Natal Harbour Board, were launched complete from the works of Messrs. Wm. Simons & Co., Renfrew. The vessels measure 137 ft. by 25 ft. by 10 ft., with carrying capacity of 350 tons. Each is fitted by the builders with a set of triple-expansion engines and steel boiler having a working pressure of 150 lbs. The hopper door arrangement is on the automatic principle. These barges are intended to accompany the two powerful dredgers already sent out to the Natal Harbour Board by this firm. One of these latter is fitted with Messrs. Simons & Co.'s patent centrifugal sand dredging pumps, and has given great satisfaction, lifting on an average each week 12,000 tons of material, which is carried seven miles beyond the bar. These barges will hereafter carry off the dredgings. The vessels were named the *William Bell* and *John Milne*, after two prominent members of the Natal Board; the naming ceremony being performed by Mrs. Hamilton, 5, Charing Cross Mansions, Glasgow, and Miss Brown, Castlehill, Renfrew.

Hornet and Wasp.—On October 14th Messrs. Mackie & Thomson launched from their yard at Govan the *Hornet* and the *Wasp*, two steam trawlers of 160 tons each, built for the British Steam Trawling Co., Hull, and intended for the North Sea fishing. Their dimensions are:—Length, 108 ft.; beam, 20 ft. 6 in.; depth, moulded, 12 ft. Each of the vessels will be supplied by Messrs. Muir & Houston, Glasgow, with a set of compound engines of 350 I.H.P. One of the two vessels will be fitted with Howden's system of forced draught—a feature new to vessels of this class, but which is expected to prove of great advantage. With the new system the speed of the vessel may be reduced more economically while fishing, and accelerated when running for market. As the other ship has been fitted with the ordinary boiler an opportunity is afforded of testing the relative merits of the systems.

Strathdee.—On October 14th there was launched from the shipbuilding yard of Messrs. John Scott & Co., Kinghorn, a steel screw steam trawler, built to the order of a firm in Aberdeen. She was launched with steam up, and was named the *Strathdee*.

Irene.—On October 16th Messrs. Napier, Shanks & Bell, Yoker, launched the steel screw steamer *Irene*, built to the order of a London firm, under the superintendence of Captain A. R. Brown, Glasgow, for service in China. The *Irene* is an awning-decked ship of about 1,350 tons gross, constructed to Lloyd's 100 A1 class, and will be fitted with sheer legs by Messrs. George Russell & Co., Motherwell, for lifting heavy weights. Accommodation is provided under deck aft for officers and passengers, while forward of machinery a large space is available in 'tween decks for steerage passengers. The vessel was named by Mrs. H. M. Napier, of Milton House, Bowling.

Darmstadt.—The Fairfield Shipbuilding and Engineering Co., Limited, from their yard at Govan, launched the *Darmstadt*, a steel screw steamer of 5,200 tons, built to the order of the Norddeutscher Lloyd, of Bremen. Her dimensions are:—Length, over all, 430 ft. 10 in.; breadth, moulded, 48 ft.; depth, moulded, 33 ft. The vessel has been constructed in accordance with the latest regulations of the Germanischer Lloyd, under their special survey, and will be classed in the highest grade of that society. She will have two polemasts of steel, with yards on the fore-mast, and will be schooner-rigged. The hull is of the best Siemens-Martin steel. There are three decks—all fore and aft—poop, bridge, and topgallant forecastle. The upper and weather decks are of teak, and the deck-houses of steel and teak. The ship will have accommodation for about 42 first-class, 36 second-class, and 2,100 third-class passengers, besides ample accommodation for officers and crew. The first-class passengers will be accommodated forward under the promenade deck in a large deck-house, where are also situated the engineer's, doctor's, and steward's rooms, and the hospitals, galleys, and lavatories. The first-class staterooms are aft of a commodious and tastefully-decorated saloon, and the smoking saloon and ladies' saloon are on the promenade deck. The quarters for captain, pilot, and officers are also on this deck. Accommodation for second-class passengers has been provided under the poop, aft of a spacious saloon. A special system of ventilation has been provided on the main and lower 'tween decks, which have been set apart for the third-class passengers. The arrangements in this part of the vessel are such that by the introduction of hammocks a large number of troops may be accommodated. When not occupied by passengers, the space on these decks will be used for cargo. The vessel will carry 10 large lifeboats and 6 collapsible boats. The danger from fire has been minimised by a subdivision of the ship, and the provision of steam injectors and an independent water service from powerful hand and steam pumps. The vessel will be lighted throughout by electricity provided by three engines and dynamos, each furnishing power for 365 incandescent lights. A steam capstan windlass, warping capstan, steam winches, and all the latest appliances for the handling of cargo have been fitted on board. Her engines are of the inverted triple-expansion type, with cylinders of 31 in., 52 in., and 83 in. diameter, and a stroke of 4 ft. 6 in. The crank shaft, which is built, is, like the propeller shaft, of Vickers, Sons & Co.'s steel, and the tunnel shafts are of Siemens-Martin steel, supplied by Messrs. John Brown & Co., Sheffield. The propeller boss and blades are of cast steel. The engines have been fitted with all the latest improvements for economising fuel, including a feedwater heater, and a fresh water producer for the boilers. Steam will be provided by two double-ended and two single-ended boilers, each of steel plates throughout. The 18 furnaces are also of steel and corrugated. The boilers have been constructed in accordance with the British Board of Trade and Germanischer Lloyd rules for a working pressure of 150 lbs. per square inch. The *Darmstadt* is similar in every respect to the *Stuttgart*, launched some time ago, and is the first of four large steamers the Fairfield Co. are at present constructing for the Norddeutscher Lloyd. As the vessel left the ways the christening ceremony was gracefully performed by Mrs. Krusé, wife of the Norddeutscher Lloyd's superintendent engineer.

LAUNCHES—Irish.

Yacht.—On October 18th a steam pleasure yacht was launched from the slip at Whitla Street. The yacht was designed by Mr. Robert Russell, and built by Mr. Wm. Scott, Frederick Street, is of composite build, and made entirely of oak. Her dimensions are:—Length, 45 ft.; breadth of beam, 8 ft. 6 in. The engines are of the compound type, and the little craft is tastefully fitted throughout.

Susannah Kelly.—On October 18th a vessel named *Susannah Kelly* was launched by Messrs. MacIlwaine & MacColl, Limited. The length of the vessel is 143 ft., while her tonnage is 350.

Memphis.—On October 18th a vessel named the *Memphis* was launched by Messrs. Harland & Wolff. She is a steel screw steamer of the highest class at Lloyd's. Her gross registered tonnage is 3,200, her length 345 ft., and her beam 41 ft. The engines are triple-expansion, made by Messrs. Harland & Wolff, with 1,600 I.H.P. She is built to the order of Messrs. Elder & Dempster, British and African Steam Navigation Co., Liverpool.

Helen Craig.—On October 18th the launch took place at Belfast of the *Helen Craig*, a steel screw steamer, built by Messrs. Workman & Clarke, to the order of Messrs. Hugh Craig & Co., Royal Avenue, Belfast. The registered dimensions of the vessel are:—Length, 165·3 ft.; breadth, 24·1 ft.; depth, 15 ft. 2 in. She is classed 100 A1 at Lloyd's.

LAUNCH—NORWAY.

Washington.—On September 27th the Bergens Mekaniske Værksted launched from their yard at Bergen, Norway, a steel screw steamer, intended for the West Indian fruit trade, and of the following dimensions:—174 ft. by 26 ft. by 13 ft. 8 in., with a deadweight capacity of 770 tons, on a draught of 13ft. mean. Her engines are triple-compound, with cylinders 14 in., 22½ in., and 37 in. in diameter, and stroke 24 in. to develop 420 H.P. The boiler is 11 ft. 9 in. in diameter, and 10 ft. long., with a pressure of 160 lbs. per square inch. She will get a speed of not less than 9 knots loaded. The vessel is named *Washington*, and is owned by Mr. R. F. Olsen, of Bergen.

LAUNCH—SWEDEN.

Christine.—The new petroleum tank steamer *Christine* was lately launched from the yard of the Burmeister and Wain Shipbuilding and Engineering Co., Copenhagen. The *Christine* is built for account of the Danish Petroleum Co., entirely of steel. Her principal dimensions are:—Length, 275 ft.; breadth, 37 ft. 10 in.; and depth, 16 ft. 10 in. Capacity about 2,400 tons gross, 1,700 tons net. The vessel is divided into twelve tanks. Each has above it an expansion tank. Forward and aft of the tanks, at some little distance, are watertight bulkheads, the interval between the tanks and these bulkheads being filled with water, so that the tank portion of the ship is isolated from the other parts of the vessel by water. The *Christine* has, besides the longitudinal bulkhead, ten others. Electric light is installed all over the ship. The tanks are calculated at a capacity of 2,400 tons petroleum; there are two Worthington pumps, each with a capacity of 1,000 tons per hour. The propelling engines are of the triple-expansion type, to indicate 1,200 H.P., and the speed should be about 10 knots.

LAUNCH—ITALIAN.

Sardegna.—On September 20th this Italian ironclad was launched at Spezia. The vessel is 410 ft. long and 77 ft. in breadth, and has a capacity of 13,940 tons. Her triple-expansion engines (of 22,800 H.P.) will propel her at a speed of 20 knots with forced draught. Her armament will consist of four 13·377-inch 68-ton guns, eight 6-inch guns, and sixteen 0·468-inch quick-firing guns, besides a number of quick-firing and revolver guns of smaller calibre and five torpedo-launching tubes.

LAUNCH—GERMAN.

Bertha.—On September 27th a steel schooner-rigged steamer, of 708 tons, was launched at Kiel, owned by Messrs. Zerssen & Co., Tonning.

LAUNCH—RUSSIAN.

Hangout.—On October 18th a new ironclad was launched with the usual ceremony from the Admiralty yard on the Neva, in the presence of the Czar. The new vessel, which was begun in October, 1888, is named the *Hangout*, and measures in length along the waterline 289 ft. 9 in., or 301 ft. 5 in. including her ram, in width 62 ft., and in depth 21 ft. She has a displacement of 6,628 tons, and engines of 6,000 H.P. Several smaller battle-ships and Imperial yachts came up from Cronstadt to salute the new addition to the navy. The Emperor and Imperial family came expressly from Gatschina, and were attended at the ceremony by all the high dignitaries and by the chief members of the Diplomatic Body.

LAUNCH—AUSTRIAN.

Kaiserin Elizabeth.—On September 24th a new and powerful protected cruiser for the Austrian Navy was launched at Pola by the Archduchess Marie Valerie. The *Kaiserin Elizabeth* is 339 ft. over all, and her beam is 47 ft. 6 in., while her mean draught with all weight on board is 18 ft. 8 in. She is built throughout of steel, and is divided and subdivided into 100 watertight compartments. As an additional protection to the safety of the vessel in action there is a complete protective deck 2½ in. in thickness, and above this, over the most important portion of the ship's length, there is a water-line belt of cellulose. Finally there are pumps which are capable of ridding the hull of water at the rate of 1,200 tons an hour. The engines, driving twin-screws, are estimated to develop 6,400 I.H.P. with natural draught, and to give a speed of 17½ knots. With forced draught they will develop 9,800 H.P., and give a speed of 19 knots. They are of the horizontal triple-expansion type, and steam for them will be generated in four double-ended cylindrical boilers. The bunker capacity is 670 tons, or enough to provide a radius of action of 4,500 knots at economical speed. There will be no sail power, but two military masts are to be fitted. The armament is as follows:—On the middle line of the ship there are two 9·4 in. 27-ton Krupps, of 35 calibres, one aft and the other forward. These are carried on the upper deck on Krupp hydraulic carriages, in barbettes 6 ft. 4 in. high, faced with 3·5 in. steel armour, and each has a training arc of 260 deg. Between the barbettes there is a superstructure in which, on each broadside and in a sponson, is mounted a 5·9 in. 6-ton Krupp, of 35 calibres. On the lower deck, also, between the barbettes and also in sponsons, are two similar guns on each broadside. Elsewhere there are two 2.7 in. Uchatius guns, of 23 calibres, 11 Hotchkiss quick-firing guns, and five or six torpedo ejectors, one of which is in the bow immediately above a solitary built-up ram. The vessel is electrically-lighted throughout. She is a sister ship, in all save a few insignificant features, to the *Kaiser Franz Josef I.*, which was launched at San Rocco on May 18th, 1889; and another craft of the same class is now under construction at Pola.

TRIAL TRIPS.

Alexandria.—On September 18th the steel screw steamer *Alexandria*, built to the order of Captain M. F. Lagoa for the Empreza Esperanca Maritima, of Rio de Janerio, made her official trial on the Gareloch. This vessel was contracted by Messrs. Kincaid & Co., Limited, of Greenock, who are the constructors of the machinery, and the hull has been built by Messrs. T. B. Seath & Co., Rutherglen. The general dimensions are as follows:—Length, between perpendiculars, 163 ft. 6 in.; breadth, moulded, 28 ft.; depth, moulded, 12 ft. 2 in.; the vessel carries 365 tons deadweight on 9 ft. draught, has accommodation for eighteen first-class and thirty second-class passengers, all above main deck. She is fitted with Hall's patent stockless anchors, and is classed 100 A1 at Lloyd's. The propelling machinery consists of a set of triple-expansion engines having cylinders 13 in., 20 in., and 32 in. in diameter, by 24 in. stroke. One steel return tube boiler, 12 ft. diameter by 10 in. long, working at a pressure of 160 lbs. to the square inch. The mean speed of two runs on the measured mile gave a speed of 9·863 knots, which was considered highly satisfactory by the owners. The vessel and her machinery has been built from the designs and under the superintendence of Mr. James Pollock, of Fenchurch Street, London.

Tynehead.—On September 20th this steamer, 272 ft. 3 in. by 38 ft. 10 in. by 20 ft. 10 in., built by Messrs. Ropner & Son, Stockton-on-Tees, for Mr. Christopher Furness, West Hartlepool, left the Tees for her trial trip. Her engines are of the triple-expansion type, of 160 N.H.P., having cylinders 21 in., 35 in. and 57 in. in diameter by 39 in. stroke, and working at 160 lbs. pressure. They were built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working well, the vessel attaining a speed of 10 knots.

Tigris.—On September 25th this vessel was taken on her trial trip on the measured mile off Tynemouth. She is 290 ft. long, 40 ft. beam, and 24 ft. 2½ in. to top of ordinary floors, and is built under the spar-deck rule by Messrs. John Blumer & Co., of North Dock, Sunderland to the order of the Persian Gulf Steamship Co., Limited, of London, and designed to carry 3,250 tons deadweight cargo, and is fitted with 500 tons of water ballast. The engines of the triple-expansion type with cylinders 23½ in., 38 in., and 62 in., with a stroke of 42 in., and two double-ended boilers 11 ft. 9 in. diameter and 15 ft. 6 in. long, are by the North-Eastern Marine Engineering Co., Limited, of Sunderland, and both machinery and hull have been constructed under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. The trial trip took place in fine weather with a light N.W. breeze, and the mean result with light ship and about 330 tons of water ballast was a speed of 11·544 knots per hour, everything working smoothly during the trial.

Marathon.—On September 25th the second-class cruiser *Marathon*, which was recently commissioned at Portsmouth for the East India Station, made a three hours' trial of her machinery. The trial was made with natural draught, the fans being slowly revolved, so as to produce half an inch of air pressure. The mean power developed amounted to 5,851 H.P., or 351 beyond the contract, the speed realised being slightly over 16 knots. The run was in every respect successful.

Mermaid.—The twin-screw hopper dredger *Mermaid*, constructed by Messrs. Wm. Simons & Co., Renfrew, to the order of the Aden Port Trust, has completed her trials on the Clyde previous to her departure for the above port, with very satisfactory results. The bucket ladder dredges to a depth of 35 feet under water level when the ladder is at an angle of 45 deg. The dredging machinery worked with great smoothness, and the work done proved that the vessel had a capacity to raise considerably in excess of that contracted for. The hopper is situated about the centre of the vessel, and has a capacity of 1,000 tons of dredgings. The engines consist of two sets of triple-expansion type, and indicate 1,200 H.P., and when tried on the measured distance at Skelmorlie, the speed obtained was also greatly in excess of that guaranteed. The *Mermaid* is the fortieth hopper dredger constructed by Messrs. Simons & Co., who are the inventors of this type of vessel, which has done so much to reduce the cost of dredging operations generally, and is so well adapted for working in exposed situations and in crowded waterways. The vessel has been built under the superintendence of Walter R. Kinipple, Esq., M.Inst.C.E., Westminster.

Genoese.—On September 27th this vessel had a successful trial. She has had a new boiler of 150 lbs. working pressure fitted by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool. The H.P. cylinder has been removed, and a new cylinder fitted of suitable dimensions for using the high pressure carried. A very extensive overhaul has been given to the hull and machinery. All the work was to the specification of Mr. G. Hepburn, consulting engineer to Messrs. John Glynn & Son, the managing owners of the vessel.

Satellite.—On September 27th the twin-screw steamer *Satellite*, built and engined by Messrs. Blackwood & Gordon, Port-Glasgow, went out on her official trial trip, when, notwithstanding the unfavourable weather, a speed of 13½ knots was attained on the average of four runs on the measured mile on the Gareloch, the vessel being partly loaded. This speed is at least one knot over what was guaranteed. The steamer is of 1,400 tons gross, and has been built to the highest class at Lloyd's. She has accommodation in handsome saloon for 30 first-class passengers, and every attention has been given to secure the best ventilation of cabins, so as to ensure the comfort and convenience of passengers in a tropical climate. She is fitted with Messrs. Napier's direct steam windlass, Muir & Caldwell's steam cranes, Wallace's steam steering gear, and all latest improvements for the loading and discharging of cargo. Her engines are two sets triple-expansion; diameter of cylinders, 15½ in., 25 in., and 40 in. by 27 in. stroke, with large boiler, and on trial they indicated 1,700 H.P. A large number of guests, invited by the builders and owners—a Liverpool firm—joined the steamer at Gourock.

Arranmore.—On September 27th about sixty guests left Prince's Pier, Greenock, on board the Clyde Shipping Co.'s new steamer, *Arranmore*. The new vessel is about 1,160 tons gross register, and is 240 ft. long, by 34½ ft. beam. She is fitted up with all the latest improvements for comfort and utility, and has a complete installation of electric light in every part. She is intended for the South of England and South of Ireland trade, and is provided with accommodation for 500 head of cattle. The builders and engineers of the vessel are Messrs. W. B. Thomson & Co., Limited, Dundee, who have built and engined several of the Clyde Shipping Co.'s vessels. The *Arranmore*, being built according to specification, was not specially tried for speed on Saturday, being run about 13 or 14 knots, the usual speed of the company's other vessels. On the run the engines developed 1,500 H.P. Owing to the inclement state of the weather the course by Kilbrannan Sound, which had been proposed, was abandoned, and the *Arranmore* made for Rothesay Bay, and steamed slowly past Craigmore Pier to allow of photographs being taken. The vessel returned to Prince's Pier about half-past five, where a number of the passengers disembarked to take train to Glasgow, the remainder coming up the river on board the steamer.

Texirinha.—On September 30th this steamer, built by Messrs. Russell & Co., and engined by Messrs. Kincaid & Co., for Messrs. Hill, Gomes & Co., Manchester and Rio de Janeiro, went her trial trip on the Gareloch, when, in spite of most disadvantageous weather, a mean speed of 11½ knots, or about half a knot over the guarantee, was attained.

Wells City.—On October 4th this vessel, 259 ft. 9 in. by 36 ft. by 20 ft. 9 in., built by Messrs. Charles Hill & Sons, Bristol, for their own fleet, left the Tees for her trial trip. Her triple-expansion engines are by Messrs. Blair & Co., Stockton, and have cylinders 21 in., 35 in., and 57 in. in diameter by 39 in. stroke, working at 160 lbs. pressure of steam. She made a most successful run, attaining a speed of about 11 knots.

Donau.—On October 4th the screw steamer *Donau* had a trial trip off the Tyne. This vessel was originally built for the North German Lloyd, but is now owned by Messrs. H. Bischoff & Co., Bremen, and is being converted into a cargo-carrying steamer intended for the cotton trade. The work of conversion has been entrusted to the Blyth Dry Dock Co., Blyth, in whose hands she has been for several months. She has been fitted with new triple-expansion engines, capable of developing 1,500 H.P., with three boilers working at 160 lbs. pressure, by Messrs. Wigham Richardson & Co., Low Walker. The trial was highly satisfactory. The mean speed on several runs over the measured mile was 11·8 knots with full power, and at a reduced power with two boilers the mean speed was 11·25 knots, the machinery working well, and without the slightest hitch.

Lapwing and Ringdove.—On October 4th the *Lapwing* and *Ringdove*, gunboats, underwent a three hours' full-speed trial of engines under natural draught, the results being extremely satisfactory. The *Ringdove* developed 70 H.P., and the *Lapwing* 724, which produces an average speed of upwards of 13 knots.

Superb.—The first-class battleship *Superb*, 22, 9,170 tons, 8,500 H.P., which has been almost reconstructed in Chatham Dockyard, has been completed so far as to permit of a preliminary trial being made of her engines and machinery, with satisfactory results. Her steam trials under forced draught in the Channel, for which she is ready, are not, however, to be undertaken until the *Thunderer*, 4, 9,330 tons, 7,000 H.P., has been put through her machinery trials, so that a comparison of the results achieved by the two vessels may be obtained. The *Superb* has been supplied with new triple-expansion engines, in addition to which she has been supplied with a heavier armament.

Elloe.—On October 6th the fine steel screw steamer *Elloe*, built by Messrs. Wm. Gray & Co., Limited, to the order of Mr. Christopher Furness for Messrs. Bennetts & Co., Grimsby, went on her trial trip off Hartlepool. The vessel is of the well-decked type, takes Lloyd's highest class, and is of the following dimensions:—Length, over all, 270 ft.; breadth, 36 ft. 6 in.; and depth, 19 ft. 5 in. The engines, which have been supplied by the Central Marine Engine Works, are of the triple-expansion type, working on three cranks. The cylinders are 19 in., 30½ in., and 51 in. diameter, with a piston stroke of 36 in.; and steam is supplied by two steel boilers at a pressure of 150 lbs. per square inch. The trial was a perfectly satisfactory one, everything working without hitch, and to the entire approval of Mr. Squires, the owners' representative, who had the superintendence of the machinery during its construction.

Ethelwalda.—On October 6th the new steamer *Ethelwalda*, which has been built and engined by Mrs. John Readhead & Sons, South Shields, for Messrs. John H. Harrowing & Co., of Whitby, left the Tyne on her trial trip. The vessel is 290 ft. between perpendiculars, 40 ft. broad, and 22½ ft. deep, moulded, and will carry about 3,700 tons on Lloyd's assigned freeboard. Her class is 100 A1 at Lloyd's. She is built of steel, and is of the improved well-decked type. She has a cellular bottom fore and aft for water ballast, and is fitted with shifting boards and bulkheads according to the requirements of the Grain Cargoes Act. The engines are triple-expansion ones, of 250 H.P., and she has extra large boilers, working at a pressure of 160 lbs. to the square inch. After the compasses had been adjusted the vessel was run several times over the measured mile, and maintained a speed of 11½ knots. The machinery worked smoothly, and the trial was considered most satisfactory in every respect.

Manin.—On October 8th the s.s. *Manin*, a steel screw steamer, built to the order of Messrs. Arthur Holland & Co., London, by Sir Raylton Dixon & Co., Middlesbro', proceeded from the Tees on her trial trip. This is the eighteenth new steamer Messrs. Dixon have sent to sea this year, and the eighth for the same owners. She is constructed on the web-frame principle having poop, raised quarter-deck and topgallant forecastle. Her chief dimensions being: Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; deadweight capacity about 3,300 tons. Her machinery, which has been fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, gave every satisfaction on trial run.

Umhloti.—On October 8th the handsomely-modelled screw steamer *Umhloti*, built by Messrs. Gray & Co., to the order of Messrs. Bullard & King, of London, for their line of steamers between that port and Natal, proceeded on her trial trip from West Hartlepool. The vessel, which is of 3,500 tons deadweight carrying capacity, takes Lloyd's highest class, is built of Siemens-Martin mild steel, and is of the spar-deck type, the following being her chief dimensions:—Length, over all, 310 ft.; breadth, 40 ft.; and depth, 24 ft. The engines were supplied by the Central Marine Works, and are of 1,100 I.H.P. They are on the triple-expansion principle, and are of the special type manufactured at the aforementioned works. One of the principal features in connection with these engines is that the high pressure cylinder is situated between those of the medium and low pressures. A special type of steam reversing gear, working on a direct worm shaft, is also supplied, by which the main engine can be reversed from full speed ahead to full speed astern in about five seconds. A convenient arrangement was likewise to be observed by which all the appliances for working the engines are brought together on the centre column within a space of two feet, thus enabling one man to have absolute control over the whole of the machinery without changing his position. All the joints about the valve gear, and other working parts of the engines, are made adjustable, the importance of which is at once apparent, and in common with all the engines turned out by the Central Marine Works, the whole of the main bearings and connecting rod bottom end bearings are lined with a high quality of white brass. During her trial the whole of these bearings were run without the application of water. The comfort of the passengers, of which the vessel will carry 30, has received the same careful attention that has been bestowed upon the machinery, the berths being well-lighted, and the saloon tastefully finished with inlaid marble panels, while the state rooms have patent fold-up washstands—a most ingenious contrivance. The *Umhloti* left West Hartlepool about 10.30 a.m., there being amongst others on board, Mr. Thomas Mudd, representing the Central Marine Works; Mr. Porter, representing the builders; Mr. J. Matthews, superintending engineer for the owners; Mr. G. Paul, of London; and Mr. Thompson, of the firm of Messrs. Kirkaldy and Co., who supplied the patent feedheaters. After steering northwards for three or four miles, her head was turned in a south-easterly direction, and Mr. Berry having adjusted the compasses, which were on an improved principle, an hour's steaming at full speed showed her to have accomplished 12½ knots, which was considered to be very satisfactory. Luncheon was afterwards served in the saloon, at which Mr. Paul proposed success to the ship and her owners. Mr. Matthews responded, and Captain Harvey, who was in command of the vessel, gave the health of the builders, and this was replied to. Shortly before four o'clock a tug, specially chartered for the purpose, took the company off the vessel, which then proceeded on her voyage to London.

Astrologer.—On October 9th the new steamer *Astrologer*, of Leith, was taken to sea from the yard of Messrs. William Dobson & Co., Low Walker, for trial of machinery. The vessel has been built to the order of Messrs. Geo. Gibson & Co., of Leith, for their Continental service, and is 220 ft. long by 30 ft. beam, and 18½ ft. deep. She is fitted with engines by the North-Eastern Engineering Co., Limited, having cylinders of 17 in., 28 in., and 46 in. by 30 in. The vessel had about half her cargo on board, and in her trial run over the mile attained a speed of 10 knots per hour.

Sharpshooter.—On October 10th this gunboat, engined by Messrs. Bellis & Co., was taken out for an eight hours' full-speed natural draught trial of machinery, when very satisfactory results were obtained. A speed of 16½ knots was attained throughout the run.

Enskar.—On October 10th the steamship *Enskar*, which has been built by Messrs. Wigham Richardson & Co., of the Neptune Works, Newcastle-on-Tyne, to the order of Messrs. George Tweedy & Co., of London, went to sea, and on the measured mile gave a speed of 11½ knots, giving every satisfaction to the owners. This vessel is built of steel, on the spar deck rule, and will carry 6,000 tons measurement of cargo, besides 300 tons of coal in the bunkers. She has also about 1,000 tons of water ballast placed under the tunnel, according to Christie's patent, and under the engine-room, as well as in deep tanks, which are available for cargo or bunkers, as may be required. She has a very complete set of machinery both for working the ship herself and the cargo, including steam windlass, steam steering gear, steam winches, &c. The engines have also been constructed by Messrs. Wigham Richardson & Co., and are on their patent four-crank quadruple-expansion type (Tweedy's patent).

Fazilka.—On October 11th this steamer, just completed by Messrs. Wm. Doxford & Sons for the British Steam Navigation Co., Limited, left Sunderland for her official trial trip when everything passed off splendidly, a mean speed of 12½ knots being attained. After trial the vessel proceeded direct to Antwerp.

Gannet.—On October 11th the *Gannet*, built by the Dunston-on-Tyne Shipbuilding Co., and engined by Mr. J. O. Spence, North Shields, had a very satisfactory trial trip, when a speed of 10 knots was attained on the measured mile.

Barrosa.—The *Barrosa*, which left Portsmouth last month for a 96 hours' experimental full-power trial under forced draught, has returned into harbour. For the first 36 hours, she did excellent steaming, with 1 in. of air pressure in the stokehold. At the end of that time she encountered a heavy fog bank, and had to ease down and make for Plymouth. Having replenished with water, she left that port on October 4th to continue her trial, but meeting with another fog, she had eventually to abandon the run, and shaped a course for Spithead. There was no trouble experienced with the *Barrosa's* boilers under service conditions during the manœuvres, but it was thought expedient to test their endurance under forced draught by a wholly exceptional ordeal, the customary run under the same conditions being for only four hours. Previous to starting, several rows of tubes were removed from the boilers for the purpose of securing superior circulation at the furnace end of the tubes, and the alteration gave such satisfactory results that no leakage took place. It will be for the Admiralty to determine whether the interrupted trial will suffice, or whether another attempt to complete a 96-hours' spin must be made.

Prins Hendrik.—On October 16th the *Prins Hendrik*, a new steel screw steamer, built and engined by Messrs. Caird & Co., Greenock, for the Stroomvart Maatschappij Nederland, of Amsterdam, went on her trial trip in trying weather, with a large company on board. The *Prins Hendrik* is a steel screw steamer of 3,450 tons gross, with triple-expansion engines of 2,600 I.H.P. She has been built to the highest class at Lloyd's. The new steamer is a large freight carrier, and her cargo gear includes several hydraulic cranes and derricks, besides other modern appliances for loading and discharging. Both externally and internally the *Prins Hendrik* is a strikingly-handsome vessel The saloon is well lighted, and occupies the whole width of the ship. The panelling is of oak and walnut, and embellished with a large number of oil paintings by some of the best known artists in Holland. The sleeping cabins are commodious, and supplied with every requisite. Provision has been made for 56 first and 24 second saloon passengers. There is a large refrigerator on board on the Linde principle, which will ensure a constant supply of ice and fresh meat on the voyage to and from the Dutch settlements in the East Indies. The sanitary arrangements in all particulars are very complete, while the appliances for the extinction of an outbreak of fire are of the most approved description. The steamer is lighted throughout by electricity, for which purpose she has two duplicate dynamos, furnishing power for about 300 incandescent lamps. Every provision has been made to secure the safety of the passengers, crew and ship. Eight large boats are carried, and these are all fitted with patent lowering and lifting gear. This is the eighteenth vessel built for the company, the last two by Messrs. Caird & Co. On account of the heavy nature of the weather, the steamer did not run the measured mile, but instead made a trip to Arran and back, in the course of which she behaved in an extremely satisfactory manner.

Kong Trygve.—On October 17th the *Kong Trygve*, after loading in Tyne Dock, proceeded to sea for her official trial trip. The vessel is the second of the same type built by Messrs. Wood, Skinner & Co., to the order of the Sondensfjeld Steamship Co., of Christiania, and is intended for the passenger and cargo service of that company between Hamburg and Christiania. The particulars of this vessel we have already in this paper. The engines, of the triple-expansion type, of 550 I.H.P., have been constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, and during the trial gave the utmost satisfaction to all on board. At the conclusion of the trial the vessel took her departure for Christiania.

Spanker.—On October 17th the new gunboat *Spanker* went out from Plymouth for a three-hours' full power trial of her machinery with forced draught. For over two hours the trial proceeded very satisfactorily, a speed of 19 knots being accomplished, and the vessel developing 3,800 H.P. Then the contractors tried to run the H.P. up to 4,000, but the additional pressure was so great that the boiler tubes began to leak. They leaked at such a rate that in a very short time the boiler was emptied, and there were quite three inches of boiling water running over the stokehold. The engine-room staff, with the greatest promptitude, pumped salt water into the boiler from the sea, and it was only in this way that a serious disaster was averted. The trial was at once stopped, and the *Spanker* returned to harbour.

Imogin.—On October 18th this vessel was taken on her trial trip from Aberdeen. Her dimensions are:—Length, 270 ft. 4 in.; breadth, 35 ft. 2 in.; and depth, 20 ft. 6 in. She is built on the spar-deck rule, and is fitted with triple-expansion engines, with cylinders 21 in., 34 in., and 54 in. diameter, and 42 in. length of stroke. There was a stiff northerly gale blowing, and it was deemed advisable to make the run to London a trial instead of running the measured mile. The vessel left Aberdeen at 2.45 p.m., arriving at Gravesend at 1 a.m. on the 20th inst., giving an average speed of quite 12½ knots, which is considered very satisfactory. The vessel has gone into the London Docks, and will be put on Messrs. J. T. Rennie, Son & Co.'s direct Natal Line. The vessel has been built by Messrs. Hall, Russell, & Co., of Aberdeen, under the superintendence of Messrs. Flannery, Bagallay & Johnson, of London and Liverpool, and has all the latest improvements, and is fitted with electric light throughout.

Oscarshal.—On October 20th the *Oscarshal* proceeded on her trial trip, after having loaded a cargo of coals in Blyth. The *Oscarshal* is the fourth steamer built by Messrs. Wood, Skinner & Co. for Messrs. Fearnley & Eger, of Christiania, and they have all been fitted with engines by the North-Eastern Marine Engineering Co., Wallsend. The engines gave the utmost satisfaction, and developed a power of 715 H.P., which, considering the rough sea, was all that could be desired. The average speed on the measured mile was found to be 9½ knots, which exceeded the guarantee. Both these vessels have been detained through the joiners' strike, and have gone away without having their cabins completed. Early arrangements have been made to finish what is required in Norway.

Monmouth.—On Wednesday, October 22nd, the s.s. *Monmouth* a steel screw steamer, built by the Tyne Iron Shipbuilding Co., Limited, Willington Quay-on-Tyne, and engined by Messrs. Wigham Richardson & Co., left the Tyne on her trial trip. The vessel, which has been built to the order of Messrs. Mark Whitwill & Son, for the Great Western Steamship Co., of Bristol. Length, 300 ft.; breadth, 39½ ft.; depth, 22 ft. 2 in. with engines 22½ in., 36½ in. and 60 in. by 39 in. stroke, with large boilers working at 160 lbs. pressure. This steamer, together with other two steamers built on the Tyne for the same company during the past twelve months, has been fitted with distilling apparatus manufactured by Messrs. John Kirkaldy, Limited, of London, and have all been under the superintendence of Mr. R. J. Cross, M.I.M.E., who has been in the employ of Messrs. Mark Whitwill & Son for the last 17 years, and was some 20 years ago well-known among the engineering and shipping firms on the Tyne. These boats being purely cargo steamers are a departure from the older fleet of Transatlantic passenger steamers owned by this firm. The trial trip was most satisfactory, and those on board expressed themselves as highly pleased with the results obtained.

Reviews.

A Technological Dictionary of Insurance Chemistry. By William A. Harris, F.R.S.S.A., F.S.S., &c., Secretary, Phœnix Fire Office, Liverpool, 1890.

This excellent work is a compendium of the latest and most reliable information on questions of great importance, not only to fire insurance companies, but to shipowners, underwriters, Admiralty Departments of Government, captains, shippers, stevedores, harbour masters, and dock masters, and as it explains the different risks which may occur in ships and at docks and harbours from spontaneous combustion, oxidation, chemical affinity, fermentation, friction, inflammability of vapours, dust explosions, steam heating and drying oils, fibres, coal, cotton, and mixed cargoes, &c., with actual cases showing when losses have occurred. Considering that every description of merchandise is now very carelessly stowed and conveyed by sea, whereby the risk of such being accidentally fired is great, the information contained in this excellent book how to minimise this hazard will be read with interest. On the subjects of spontaneous combustion and gas explosions of coal cargoes, the author has written very fully, and his facts and arguments indicate very much research and learning. His statements on these questions are exceedingly valuable, and if the recommendations contained therein are followed by shippers of coal, these accidents will rapidly diminish. The author's remarks upon fires at sea and fire hazards from the defective stowage of highly inflammable chemicals should be well noted as a great number of accidental ignitions therefrom are preventable. The fire risks attending the warehousing of goods for shipment should be read with great care by dock and harbour masters. As there is much fire waste annually in connection with shipping that is preventable, it is highly incumbent upon Government departments and ship and dock owners to do all they reasonably can to diminish it, and very much reliable instruction for this purpose can be gathered from Mr. Harris's dictionary, which we have briefly noticed.

Electro Motors: How Made and How Used. By S. Bottone. Whittaker & Co.

The progress of technical literature seems to keep well abreast of the times, judging by the work the proof sheets of which are before us. Many electricians consider that motors for utilising current are in their infancy, and that information concerning them is not very general, yet here is an author who seeks to educate the public on this very interesting topic, one which may be said to have a great future before it. The principles enunciated at the beginning are of the simplest character. This is as it should be, provided the remarks are contained within proper limits. The reader is then taken on step by step through all the various forms of motors, and eventually to the economical method of working them. It would have been better, perhaps, if the author in his title and throughout the volume had confined himself to the question of how motors are made, as he takes 126 pages to do this in, whereas he dismisses the subject of the utilisation of the motion in four short articles. However, there can be no doubt the construction of electro motors is treated in a way that commends itself here. If a thorough study is made of the matter found, an engineer of average intelligence ought not to want to go much outside for anything to help him in this special line. For example, under the heading of "preliminary considerations" there is found at Fig. 5, page 12, the most elementary type of motor that could be probably put together. This is shown to work with a permanent magnet. In the next form the electro magnet is introduced. The objections to the former are clearly stated, as also the advantages of the latter. Chapter ii. is headed, "Interrupted Current Motors." Here the "Siemens" armature is only noticed. The opinion is expressed that this style is the most efficient as regards the power obtainable from a given mass of iron, but that the motor has dead points from the fact that the commutator slits may come to rest opposite the brushes, and in this position the machine will not start itself. We are thus led on to motors which will take up motion in any position, and which form a heading for chapter iii, under the name "Uni-direction Current Motors." The body of the work is all brought to bear upon this branch of the subject. We find illustrations of details and complete machines all fairly-well brought out. Considerable space is allotted to a description of the Immisch motor, and this is said to stand at the head of all English makes. Other forms are gone into, viz, the Ayrton & Perry, the Henry, and the Lugo. Several plans of reversing the direction are also described. Chapter iv. is devoted to the "alternating current" system. The explanations are very clear and readily understood. The Mordey motor receives due attention in this connection, as also the Testa type, then follows the Westinghouse, and that of an American, Mr. Bradley, all being illustrated. With the exception of what we stated at an early portion of these remarks there is much that call for hearty commendation in the volume before us. Anyone with a knowledge of engineering in general would have no difficulty in following all the author has to tell him respecting motor construction, and he could not fail to be a gainer thereby.

Rules for the Concentric Wiring of Buildings and Ships.

Under the above title Messrs. J. D. F. Andrews & Co., 41, Parliament Street, S.W., issue a neat little pamphlet. This firm make a speciality of this system, and, as an effort to bring some sort of order where there is a want for it, they have brought out this set of rules. They commence by saying the concentric principle must be carried into every detail of the installation, the switches, fuses, fittings, &c., as well as the joints, should be so constructed that one conductor is completely contained within the other and effective insulation provided between the two by an entirely non-inflammable substance. Rule 4 says "the surrounding conductor of the cable must be a compact tube, completely covering the surface of the insulation. It may consist of copper, iron, or any other metal fusible at a high temperature, but no metal fusible at a low temperature, such as lead, may be used as a conductor, though such metals may, if desired, surround the conductor. The conductors may be constructed of wires. strips or tubes." Rule 5 says "the distance between the central and surrounding conductors must be as small as possible, due care to be taken that the quality and degree of the insulation is maintained." Respecting insulating material Rule 8 says it must be "impervious to moisture and stand a temperature of 160 dgs. Fahr. without softening or change of any kind, and must be a material that does not change by time. Its insulation must be as stable in water as in air." Other rules treat of jointing wires, junctions with different parts fixing conductors, leading the wires, fuses, switches, switchboards, resistances, arc lamps, fittings, dynamos, accumulators, motors and transformers, 53 in all. These rules would certainly be useful to anyone charged with the supervision of an installation already fitted, as many engineers are. Their practical character may be very well judged by what we have quoted. Our remarks apply where even the concentric system is not adopted, though of course the rules are really intended more especially for this mode of wiring. There are extra ones for shiplighting. These relate to the requirements of the compass, petroleum-carrying vessels, cargo spaces, and signal lights. As regards the second of these, it is enjoined that the insulation, switches and fuses, should be protected from the action of oil vapour in every way. Wires in cargo spaces must be provided with a special switch, having a removable key, placed exterior of such space for use when the hatches are down. Signal lights should be furnished in duplicate, so as to keep up the light constantly.

Wiring by cable offers such advantages from the dangers of fire through short circuiting as to be patent to the simplest understandings. When heating does take place inside a tube it obviously cannot do much damage. Older methods are therefore more and more likely to be superseded as time goes on, by placing one wire within the other. We can recommend the rules to all those interested in the subject.

Miscellaneous.

Institute of Marine Engineers.—We are requested to notice that this Institute has arranged to hold a meeting on the *second* and *fourth* Tuesday of each month, and that these meetings will be devoted to the reading of papers and discussion thereon. This arrangement is a good one, as members will now know, without receiving any special intimation, on which evenings papers may be expected to be read. Several papers of interest are in course of preparation, and the winter session promises to be a thoroughly profitable one. It has, we learn, been decided to have a conversazione in the Town Hall at Stratford, on Friday, the 5th of December next, for members and their friends. The committee is now making the necessary arrangements, and will be glad to receive offers of assistance from members, either towards the programme, or the hall decorations, such as interesting exhibits, models, photographs, flowers, &c., and we trust that their efforts will be crowned with success.

Northern Shipbuilding Conference at Sunderland.—An important conference of Wear, Tyne, and Tees master shipbuilders was held at the Grand Hotel, Bridge Street, Sunderland, on October 21st. Mr. James Laing presided. Representatives of the Boilermakers' and Iron Shipbuilders' Society, including Mr. James O'Neil and Mr. Keith, waited upon the masters, and discussed with them the question of overtime in the different shipyards on the three northern rivers, as well as night-shift work. A strong disposition was manifested by the men to discontinue the present practice, but no definite decision was arrived at. The men were asked their opinion with reference to the dispute between the joiners and shipwrights on the Tyne, with the object of bringing about a settlement of that dispute. They, however, replied that the matter was one which did not concern them, more especially since the offer of the Mayor of Newcastle to act as mediator had been accepted.

The Russian Imperial Yacht.—The *Polar Star*, the new yacht of the Emperor of Russia, which was launched last May, and which is, with the exception of the ill-fated *Liradia*, the largest yacht afloat, has not given satisfaction on her steam trials. The speed realised was 2½ knots less than the 17 expected, and it has been resolved to fit her with a new pair of twin-screws. She will accordingly have to return to the dock at St. Petersburg for the necessary alteration.

A Proposed German Exhibition.—The next of the series of national exhibitions promoted by Mr. J. R. Whitley, at Earls-court, which began with the American Exhibition, held in 1887, will be devoted to the arts and industries of the German Empire. The exhibition will be open from May till October. 1891, and a very large portion of the expenses, amounting to about £70,000, will be borne by the promoters. The extension of commercial relations being considered to be the principal use of exhibitions, no commission will be charged on sales. The most representative members of the German colony in London will constitute an advisory committee with a view to ensuring the success of the exhibition.

We have received a copy of the Phosphor Bronze Co.'s catalogue. It is neatly got up in flexible covers. The main purport of the work appears to be to instruct buyers in the various uses to which the company's productions may be applied. With such an article it is very necessary to educate the public. It may be said generally there does not appear to be a purpose for which phosphor bronze in some form is not applicable. The present issue gives testimonials from the leading works, &c., of the country as to the value of the speciality, and finishes with two tables, one respecting the weights and electrical resistance of Weiller's Patent Silicium Bronze Wire, the other a report of trials made upon Bull's Metal by Mr. Stanger, C.E., both articles belonging to the company.

The Mersey Bar Dredging Operations.—The engineer to the Mersey Docks and Harbour Board (Mr. G, F. Lyster) reports that the dredging operations at the Mersey Bar have been remarkably successful. The apparatus has been at work about one month altogether, allowing for interruptions caused by severe weather and the equinoctial gales, and during that period about 20,000 tons of sand has been removed to the place of deposit about two miles distant towards Crosby. This hopper steamer and its sand pumping apparatus was constructed by Messrs. Wm. Simons & Co., Renfrew, the latter being a patent of this firm.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

"THE HOLMES TORPEDO FINDER."

To the Editor of The Marine Engineer.

Sir,—Our attention has been drawn to an article in your October issue, under the above title.

From this article one is led to believe that the torpedo indicating lights are quite a new invention, and that the idea belongs to Mr. Joseph R. Holmes; that such is not the case we are quite willing and ready to prove beyond doubt to any one who may have any interest in the matter.

Torpedo indicating lights, or finders as they were first called, were introduced by the late Mr. Nathl. John Holmes, the founder of this Association, and father of Mr. Jos. R. Holmes, fully twelve years ago, and they have been in use by our own and other Admiralties since that time.

We may here state that from the sketch you give, it is evident the original pattern of torpedo indicating lights has been shown to you, and not the new ones which were used by the Admiralty in the late Manœuvres, and which in fact have been used by them for some years back. The idea was not patented originally, but since then patents have been granted for certain improvements of which we are the proprietors, and on the strength of these our Admiralty have given us the whole contract for making and supplying their torpedo indicating lights so long as these patents last.

We think you will see from this how absurd and misleading the claim set up by Mr. Joseph R. Holmes is, and we trust that in fairness to us you will insert this letter in your next issue.

We are, Sir, yours truly,
Maxwell & Glen,
Proprietors of Holmes' Marine Life Protection Association.
8, Great Winchester St., London, E.C.
October 20th, 1890.

FAST ATLANTIC PASSAGES.

To the Editor of The Marine Engineer.

Sir,—In your contemporary, the *Journal of Commerce's* issue of the 17th October, they remark the performance of the *Columbia* in her last homeward voyage, which broke the record to Southampton. They state that this performance is equivalent to a passage of 5 days 21 hours to Queenstown. This is surely an error. Unfortunately I cannot obtain the log of the voyage in question, but I think I have sufficient data to prove my point without it. I have the logs of her first three homeward voyages, and from them I make her average distance from New York to Southampton to be 3,083 miles. They give the passage as 6 days 21 hours from New York to Southampton, and the average speed to be 19·15 knots, and from this I see that I am not treating her unfairly by taking the distance steamed to be 3,083 miles. In a note I give details of the passages of four Liverpool vessels from New York to Queenstown. You will see the average distance this route eastwards is 2,775 miles. If the *Columbia* did 3,083 miles in 6 days 15 hours, her passage to Queenstown, doing 2,775 miles, would be only 5 days 23 hours 6 minutes and not 5 days 21 hours; but as you give her average speed as only 19·15 knots, I am inclined to believe that her distance this voyage was considerably less than I took it at, and her equivalent passage to Queenstown consequently so much longer. At all events the New York and Queenstown steamships think little of an average of 19·15 knots on an eastward voyage, as there are at least four vessels, the *City of Paris*, *Majestic*, *Teutonic*, and *City of New York*, which beat it, and I have little doubt that I could prove that the *Umbria* and *Etruria* do so, too, if I were not afraid of encroaching too much on your space. The *Columbia's* performance is undoubtedly a fine one. I do not wish to detract from it; but it in no way approaches the New York-Queenstown performances, and that should be made plain.

—Yours &c., B. W. Ginsburg.

Ship	Year.	Number of Ship's Voyage.	Mail News, "Times"		Official Passage.	Total Distance.	Average Speed.
			Left New York.	Arrived at Queenstown.			
Majestic	1890	6th	10 a.m. 3rd Sept.	2.14 p.m. 9th Sept.	5d. 23h. 16m.	2812	19·62
Teutonic	1890	13th	9 a.m. 17th Sept.	1.49 p.m. 23rd Sept.	5d. 23h. 14m.	2794	19·49
City of New York .	1890	17th	8.35 a.m. 17th Sept.	1.36 p m. 22nd Sept.	5d. 23h. 14m.	2773	19·35
City of Paris	1889	10th	9 a.m. 25th Dec.	1.20 p.m. 31st Dec.	5d. 22h. 50m.	2721	19·05

Note.—The City of Paris averaged a much better speed on her (2nd) homeward voyage, when she made the passage in 6d. 0h. 20m., but covered 2,894 miles—a speed of 20·038 knots—a speed which, as far as I know, no Southampton boat ever even approached

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We have received from Messrs. John Brown & Co., Limited, Sheffield, a little compendium of sets of tables relating to boilers. This firm have recently taken up the manufacture of furnaces by Purves' patent, and it is in connection therewith that the present issue is made. First the formulæ for finding the working pressures that may be allowed on stayed flat surfaces is given, and then the resultant tables. These are from ¼ in. thickness up to 1½ in., the pitch of the stays being from 7 up to 19 in. The stays are in one case screwed with riveted heads, in another with single nuts, again double nuts, and lastly double nuts and washers. The next tables refer to pressures due to varying diameters of round stays. Afterwards cylindrical shells are dealt with, taking into account the different forms of joints and allowances to be made. Finally, we come to the formulæ and tables deduced therefrom for ribbed, corrugated and plain furnaces up to 52 in. diameter and ⅝ in. thick. Engineers may find a collection of tables like this handy, though, as with all calculations worked out ready for use, some skill is required in the application.

North-East Coast Institution of Engineers and Shipbuilders.—The annual general meeting of this Institution was held in the lecture hall of the Literary and Philosophical Society, Newcastle-on-Tyne, on the 13th October last, when the sixth annual report and financial statement were submitted and adopted. The council having elected Messrs. Francis Carr Marshall, Tynemouth; William Boyd, Newcastle-on-Tyne; Robert Thompson (of Messrs. J. L. Thompson & Sons), Sunderland; and Henry Withy, West Harpool, to represent, for a term of four years, the shipbuilders and engineers of the North-East Coast District, on the new sub-committee of Lloyd's Register of Shipping, their names were submitted to the general meeting, and their appointment duly confirmed. The investment of two sums by the trustees, with the Tyne Improvement Commissioners upon a mortgage of the Tyne Consolidated Fund, for a period of ten years, was approved of, and this investment not falling within the terms of the instruments creating the trust, this special resolution was passed in order to relieve the trustees from any liability in consequence of their having stepped outside, so far, the term of the trust. The president then delivered his inaugural address. The general meetings for the session will be held on various dates up to May next in Sunderland, Newcastle-on-Tyne, and West Hartlepool.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from September 16th to October 15th, 1890.

14572 T. Foulds and W. Graeber. Exhaust steam receiver.
14660 C. McLaren. Stuffing boxes of steam-engines.
14741 J. Cooper and T. Pattinson. Pistons.
14747 R. Hunt. Reducing friction in ship propulsion.
14750 W. Brindle. Reciprocating steam-engines.
14762 G. Lang. Screw propellers.
14845 E. C. Urry and G. A Farini. Multiple expansive steam-engines.
14937 A. Leslie. Valves (G. Brunton, India).
15027 H. Turner, W. Bayliff and T. D. Bayliff. Pistons and piston packings.
15143 E. T. West-Field. High speed steam-engines.
15142 H. T. Liversedge. Compound rotary engines.
15156 G. J. Davis. Packings for glands or stuffing-boxes.
15220 J. Howden. Valve gear for marine and other engines.
15299 G. Bernard. Marine engine governor—self-acting.
15403 A. Bushbye. Marine steam boilers.
15445 L. C. Brickenstein and C. A. J. Babendreier. Steam boiler feeders.
15464 T. Sullivan, J. W. Hughes, V. W. Chemery and A. H. S. Browne. Apparatus for governing electric light engines.
15471 R. Marshall and E. Fitz-Gerald. Packing for stuffing-boxes.
15535 A. W. P. Blunt. Propellers.
15545 Francois Van Rysselberghe. Engine governors.
15581 The Mills Patent Sectional Boiler Co., Limited, and J. Mills. Water-tube steam boilers.
15591 B. H. Thwaite. Steam generators.
15611 R. Wilcox. Rotary engines.
15663 H. J. Simpson and H. E. Simpson. Apparatus for pumping water.
15688 E. Edwards. Pump valves (L. H. Monfils, France).
15695 C. T. Snell and B. M. Fletcher. Thrust blocks and similar bearings.
15723 J. H. T. Bradley and J. Colquhoun. Propulson, steering and floating torpedoes, ships, &c.
15780 C. Legge. Steam and hydraulic propulsion.
15797 E. Petersen. Tubular steam boilers.
15807 A. J. Campion and J. E. Tenison-Woods. Steam boilers and motors.
15812 F. Morris. Ships' screw propeller.
15825 H. Carlisle. Piston valves.
15896 J. Baird. Steam boilers.
15915 C. Rea Joyes and C. Fouracre. Safety valve for steam boilers.
15917 L. W. Winnall and F. W. Barber. Marine vessels.
15949 J. Wood. Steam boilers.
15966 J. P. Bayly. Steam-engines (G. Carey, U.S.A.).
15975 G. J. Davis and E. Jones. Steam cylinders and pipes.
16032 G. D. Wansbrough. Expanding piston rings (J. Booth, Natal).
16087 W. James. Valves.
16114 R. G. Ruffles. Tubular steam boilers.
16118 R. Renault. Safety valve for steam boilers.
16120 F. W. Jacob. Apparatus for indicating the overheating of the bearings of machinery.
16141 W. Jowett and G. Spencer. Pistons.
16142 J. Barker and F. Shaw. Sight feed lubricators.
16152 G. Twigden. Piston for steam-engines.
16170 J. P. Bayly. Reversing valve for steam engines (A. Engelbach, U.S.).
16183 J. I. Thornycroft. Steam generators.
16204 F. W. MacDonald. Lubricators (Norbert De Moor, Belgium).

New Steamship Boiler.—The steamship *Liban*, of the Compagnie Fraissinet, arrived on Thursday, October 16th, at Marseilles from Genoa, having made a first trial of the new boilers devised by the company's engineers. The bodies of the boiler are only four in number, instead of eight, and a speed of 11 knots is attained with a consumption of 70 kilogrammes of coal instead of 140 as before.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

September 27th, 1890.

Bach, Charles	2C	Bristol
Bevan, Wm. D.	1C	L'pool
Cattell, Jos. W.	2C	Cardiff
Collins, F. D.	2C	Sunderl'd
Cook, James ..	1C	Aberdeen
Coutts, John ..	2C	London
Elliott, Matthew	2C	,,
Gawthorp, J. H.	2C	Hull
Gilroy, Thos. R.	2C	L'pool
Gregory, H. N.	2C	Cardiff
Hansen, John E.	1C	N.Shields
Howart, Joseph	1C	L'pool
Irvine, Wm. H.	2C	Sunderl'd
Irving, J. J....	1C	L'pool
Kelly, John J...	2C	,,
Lawson, L. ..	1C	,,
McKay, Alex. ..	1C	London
McLachlan, Jas.	2C	Aberdeen
Mitchell, John	2C	Hull
Murphy, Wm. A.	2C	Sunderl'd
Randall, A. E.	1C	London
Ridley, George	2C	N.Shields
Smith, James ..	1C	London
Smith, Joseph	2C	L'pool
Thomson, Wm.	1C	Sunderl'd
Vaux, John C.	2C	,,
Walker, Sam. H.	2C	L'pool
Walls, James C.	1C	,,
Watkins, Wm.	2C	Cardiff
Watson, John ..	2C	N. Shields

October 4th, 1890.

Anderson, A. B.	2C	Glasgow
Bain, Wm.	1C	,,
Brunsden, G. F.	2C	,,
Connell, John ..	2C	L'pool
Dalkins, J. C. ..	1C	N.Shields
Dennant, Wm. J.	1C	London
Gambles, John	2C	L'pool
Gilbraith, F. W.	2C	,,
Halliday, J. R.	1C	Glasgow
Hardmann, E.	1C	L'pool
Innes, Alex. ..	1C	,,
Jackson, T. Jas.	1C	N.Shields
Kerr, Robert ..	2C	Glasgow
Laidlaw, Geo. B.	1C	,,
Laird, Alex. ..	2C	,,
McCuaig, D. ..	1C	,,
Mitchell, H. F.	2C	L'pool
Paterson, H. M.	2C	Glasgow
Sim, William ..	2C	,,
Taylor, Wm. ..	2C	N.Shields
Thomson, Wm.	2C	London
Whyte, George	1C	Glasgow
Williams, Robt.	2C	L'pool
Wilson, Chas. G.	1C	London

October 11th, 1890.

Allan, John W.	2C	N.Shields
Barnett, Alf. J.	2C	London
Blyth, John ..	2C	Dublin
Crawford, H. K.	2C	London
Gibson, Hugh ..	2C	N.Shields
Greenstreet, F.E.	2C	London
Grieves, Wm. A.	1C	N.Shields
Kelly, Alfred S.	1C	London
Lawrie, Peter S.	1C	,,
Mackenzie, A. G.	1C	N.Shields
Mounteney, C.	2C	London
Orme, Jos.	1C	L'pool
Park, William	1C	,,
Srommurze, S.	1C	,,
Thompson, J. T.	2C	N.Shields
Wymer, Chas. R.	2C	London

October 18th, 1890.

Anderson, L.	1C	Leith
Armsden, J. H.	1C	L'pool
Barnard, M. ..	2C	London
Blackburn, G. H.	1C	N.Shields
Bruce, Lawrence	2C	Greenock
Buckley, James	2C	Cork
Clouston, John	2C	London
Dalgety, Wm. D.	2C	Dundee
Deason, Jos. J.	1C	London
Dodds, Allan ..	1C	N.Shields
Duncan, Chas. T.	2C	,,
Forbes, Thomas	1C	Greenock
Harland, Jas. W.	2C	N.Shields
Harley, Wm. ..	1C	Leith
Harris, Frank	2C	London
Henderson, J. W.	2C	L'pool
Hislop, Richard	1C	Greenock
Hunter, Hugh	1C	L'pool
Macdonald, H.	2C	Greenock
Mackenzie, Jno.	1C	Leith
McDonald, Alex.	1C	Dundee
McMannes, Wm.	2C	,,
Miller, Alex. ..	1C	Greenock
Mills, Wm.	1C	London
Moir, Norman	1C	Leith
Neill, Arch. W.	1C	Greenock
Nisbet, Geo. H.	2C	London
Nutt, Chas. R.	1C	,,
Ore, Wm. E. ..	1C	,,
Rae, John	1C	Leith
Robertson, Jas.	1C	Greenock
Scott, Wm.....	1C	Leith
Semple, Robert	2C	Greenock
Shearer, David	1C	,,
Sholl, Albert ..	2C	London
Stevenson, Alex.	2C	Greenock
Stewart, D. McF.	1C	,,
Taylor, W. T...	1C	Leith
Thomson, J. K.	1C	Greenock
Wood, George..	2C	Dundee

New Second-class Cruiser "Apollo."—An addition will be made to the Royal Navy on November 13th by the launch of the new second-class cruiser *Apollo*, one of the vessels included in the programme provided for in the Naval Defence Act. The *Apollo* is 300 ft. long, 43 ft. broad, and has a displacement of 3,400 H.P. Her engines, supplied by Earle's Shipbuilding Co., are to develop 9,000 H.P., and are to propel her at a measured mile speed of 20 knots under forced draught, and 18·5 knots under natural draught. Her armament will consist of two 6 in. breech-loading guns, six 4·7 in., and nine 3-pounder and 6-pounder quick-firing guns, together with a strong torpedo equipment. The *Apollo* has been built at Chatham Dockyard.

The Marine Engineer.

LONDON, DECEMBER 1, 1890.

NICKEL-STEEL seems to be coming prominently to the front as a novel material for armour-plates. Recent trials have taken place with this material in competition with English compound steel-faced armour, and it is reported that the trials have terminated favourably for the nickel-steel plates, the production of a French firm. Such reports must be taken with a grain of salt until more exact details are to hand, and until confirmation or otherwise is obtained at home, since it is a well-known peculiarity of our American cousins to depreciate anything that is British. So far does this idea seem to have taken hold of the U.S.A. Press that they are reporting that it is the intention of the British Government to order the compound plates to be ripped off every cruiser and every man-of-war that flies England's flag. It is claimed also that nickel-steel is the best material for boilers, and that all boilers of other material may now be considered obsolete. Should there be any truth in the exceptional qualities of nickel-steel, we have no doubt that England and English manufacturers will lose no time in fully testing and taking advantage of this new discovery. In fact, it is reported from the U.S. that a strong English syndicate have already bought up all the patent rights for the manufacture of nickel-steel in England and America. It would appear that the principal patentee is an Englishman, Mr. J. F. Hall, of Sheffield, which we are glad to note for the credit of our mother country. It is obvious that, should nickel-steel become a popular favourite, as its supposed merits would warrant, the supply of nickel must be carefully looked up and controlled, or contracted for, so that its price shall not be raised upon the market. It has often been suggested that other steels than the ordinarily-known carbon-steel have superior properties in many respects to those at present commonly in use. Chrome-steel a material not unknown in the English engineering orld, and we have heard that phosphorus-steel, with total absence of carbon, might prove an alloy or ompound of very great commercial value.

THE application of forced draught in the Navy has now become practically an accepted fact, but practical results have hitherto been always attended with great deal of trouble arising from leaking tube ates. It would appear that little is actually known the circumstances which give rise to this serious wback attending the use of forced draught in rine boilers. When a comparison is made between the action of multi-tubular marine boilers and those of locomotives which are very similar in construction, one finds oneself left in a dilemma to account for the very different action of these boilers under comparatively equal conditions. Of the two forms of boilers the locomotive boiler seems to be under the worst conditions, since the average rate of coal combustion per square foot of grate area is as a rule much higher in the locomotive than in the marine boiler, even with ordinary forced draught. It is perhaps scarcely fair to assume that the locomotive boiler gives no trouble in leaking, since it is a practice with these boilers to give them a rest for overhauling once in every 7 days, and it is even within our own experience to be able to state that some attention to leaky tubes and leaky rivets in the fire-box is always a part of the attention required for renovation in the running shed. However it is seldom one hears of such leakage amounting to anything sufficiently serious to interfere with the practical running of the locomotive, whereas it is not unknown in marine boiler experience that the leakage should become so suddenly excessive, as to extinguish the fire and practically to put the marine boiler *hors de combat*. We find however a curious and interesting statement in regard to the conduct of certain locomotive boilers communicated in the correspondence columns of one of our contemporaries, in which it is reported that such locomotive boilers of small tube area and large evaporating surface developed suddenly and unexpectedly this selfsame characteristic of sudden and excessive leakage when subjected to heavy strain almost immediately after their delivery new from the works. A peculiarity noticed was that in spite of excessive leakage when running sufficient to put out the fire, the tubes were found to be afterwards tight when cool. This drawback was avoided in the case of the locomotives in question by a curious precaution, viz., by special instructions the locomotives were not allowed to be worked up to their maximum efficiency or under any excessive strain until they had been running under an easy load for some time, and the boilers and tubes had had time, as it was termed, to settle down. This practice was found a complete cure for the boilers. Though it affords no explanation as to the circumstances, and does not appear to suggest any particular theory, it is known in practical circles to be a most potent fact, that both machinery and boilers have queer habits when first constructed, both as regards leaking, priming, and running hot, which tend to set down after a short period of easy work. From this then it would appear fair to deduct that marine boilers are liable to appear at their very worst when tested up to maximum efficiency on their trials, almost immediately upon their being completed and while in a new and raw condition. As most disasters arising by excessive leakage in marine boilers appear to occur chiefly in the speed trials, we think it probably might be avoided if both engines and boilers were subjected to a short period of easy working before being subjected to their maximum speed trials. There seems to be two chief suggestions as to the probable cause of this excessive leakage; one, depending upon the peculiar character of the water, as chiefly used in marine boilers as compared with that used in locomotives; and the other, the distinctive character of the forced hot air blast in marine locomotives being an accumulation in the fire-box or combustion chamber under pressure, in comparison with the chiefly-induced forced draught of the locomotive. The theory under the first head is that as the water used in marine boilers is constantly renewed from the products of condensation, special condensed water is known to have an entire absence of aëration. All occluded air is removed by the air pump of the condenser. It is known that such a non-aërated "still" water does not evaporate so readily, or at such low temperatures, as aërated water. In the locomotive it is noticeable that the water supply is always from fresh water, containing a considerable percentage of aëration, and where supplied by an injector, or feed pump, it is apt to receive further proportion of aëration whilst being fed. Under the second theory it is suggested that the evil of excessive leakage experienced may arise from an unequal concentration of temperature at certain points, of which the tube plate would be the most conspicuous. The plan of forcing air into the fire-box or combustion chamber in large volumes, from which it is only free to escape through the minutely-divided tube areas, will probably tend to keep up a concentration and impingement of hot air upon the face of the tube plate in the fire-box, where most of the damage is experienced. In the locomotive, on the other hand, the induction of the forced draught is chiefly due to the action of the exhaust blast in the funnel, and any excess of air thereby induced is drawn first through the tubes, and thence in a uniform and quickly distributed manner through the fire-box and tube plate. We shall be glad if our many readers and correspondents will favour us with their individual experiences upon these points, so that a subject, at present involved in considerable doubt and mystery, may receive elucidation by the comparison of actual facts within the knowledge of sea-going engineers.

The past month has been one signalised by a series of disasters, prominent of which has been the entire loss of H.M.S. *Serpent*, accompanied by a disastrous loss of life amounting to 173 all told. The *Serpent* left Devonport for the West Coast of Africa, and had the misfortune to run upon the rocks near Camarinas, a small town not far from Corunna and Cape Finisterre. The night was very dark and no help was obtainable from the shore, which is a wild, deserted spot, and the blue-jackets were swept away repeatedly by the heavy seas that constantly broke over the ship. It is natural in face of such a disaster to pay some special attention to the vessel in question, as to whether anything may be learnt as to weak points of construction in her design. It would appear, however, that although a heavy gale was blowing, the disaster was not due to any absolute disablement at sea, but rather to ignorance of the dangerous proximity of the rocks. The *Serpent* was one of a class of light cruisers, consisting of eight ships, viz., *Tartar, Brisk, Cossack, Porpoise, Mohawk, Racoon*, and the *Archer*, which were designed to combine speed and endurance with lightness of construction. It is to be feared that the lightness of construction was carried somewhat to the extreme, as Lord Brassey, in the Naval Annual of 1890, says, "In the construction of the hulls economy of weight has been carried to excess. The plating is too thin for durability; the armament is overdone. In a sea-way the heavy top weight causes loss of speed and throws an undue strain upon the light structure upon which it is placed." The *Serpent* carried six guns, consisting of six 6-inch 5-ton breech-loading rifled guns, with a further complement of Nordenfeldt guns, 3-pounder quick-firing guns, and torpedo tubes. The displacement is 1,770 tons; the length, 225 ft.; with a 36 ft. beam; the total I.H.P., 4,500, and her total cost was about £121,000. It is reported that the *Serpent* upon striking had her bottom ripped open, and that the water poured in by tons through a huge rent, so that she went down in deep water before a boat could be launched and before anyone on board could take any measures for preserving their lives. A large number of those drowned were, it is said, unable to reach the deck at all. It appears that this vessel and her consorts have never been liked in the Service; several Admirals have concurred in condemning the whole class, and it has been reported that former experience at sea showed that they were quick rollers, and consequently unsteady gun platforms, and pitched heavily owing to the great weight in the bows. There appears to be over 34 tons of deadweight carried on the forecastle. It is unanimously reported that the armament is heavy, and that the weights on the forecastle are too great, and that the forecastle itself is not strong enough for the weight which it has to bear. It is said that in one of the vessels of this class, when going 10 or 11 knots against a moderate swell, a sea was taken on board which sufficed to bend the forecastle beams down 3 in. It is probably inevitable that all our new naval designs will require practical tests before their qualities—good, bad, or indifferent—are in any way realised, though the experience may cost us dear. We think it is probable that had the vessel not fallen foul of the rocks, no disaster, in spite of the heavy weather prevailing, need have occurred, and that when once an ironclad has struck a rock on a lee shore, no solidity of structure would serve to preserve her from disaster.

THE VAUHAN-SHERRIN ELECTRICAL GENERATOR AND MOTOR.

IT has long been the aim and the ambition of electricians to discover some means of propelling boats, carriages, tramcars, &c., by electricity without accumulators, and hitherto this has been regarded as almost an impossibility. The invention which we here describe has accomplished this.

Mr. Vauhan-Sherrin's experiments have lately been directed to certain forms of electric locomotive power, and the results obtained by him are somewhat astonishing. These comprise, among other matters, a special form of primary battery, having a high electromotive force as well as a remarkable maintaining power; a special form of motor of very high power and efficiency in proportion to its weight; and various combinations of these for the purpose of electric locomotion, particularly in relation to the propulsion of launches, tricycles, carriages, cars, &c.

The primary battery used by Mr. Sherrin is a two-fluid battery, in which the anodes are of sheet zinc, and the kathodes are of carbon, specially prepared. In each cell there are three fixed kathodes and two replaceable anodes. Very light plates are used, and the particular construction adopted permits these to be placed very close together, so that the resistance to the flow of electricity internally is very small. The outer cells are of gutta-percha, and in them are embedded the porous cells which surround the anodes. The liquid used in the inner cells is simply water, that placed in the outer cells around the carbon kathodes is a depolarizing liquid of special composition, capable of being produced at a very low cost. It is to this special composition that the cells owe their high electromotive force—nearly two volts each—and their excellent staying power. In one of the tests made by Professor Silvanus P. Thompson, B.A., D.Sc., &c., and mentioned in his able report on Mr. Vauhan-Sherrin's invention, one of these cells gave out an average current of 8·75 amperes for five consecutive hours, with an average electromotive force of 1·88 volts, although the cell was only about half filled at starting. Professor Thompson says that he knows of no battery, primary or secondary, which, for a given gross weight of cell, will yield as great an output, while the economy of zinc is remarkable, the consumption being close to the theoretical limit, and he estimates the net cost of electric energy from such cells at 9d. to 10d. per Board of Trade unit.

The motor is a modified two-pole gramme machine, having the field-magnets constructed in a special manner, which, while maintaining great mechanical strength, admits of perfect lamination of the iron. It is well designed and constructed, and, when properly set, is remarkably free from sparking at the commutator. It is also wonderfully light, a one-horse power motor giving only 62 lbs. of deadweight.

Of course the adaptation of this invention to the propulsion of vessels is what we have more immediately to do with, but its value as a motive power for land travelling must not be lost sight of. This is great, and some very satisfactory trials have been made with a bath-chair and a tricycle, fitted with this generator and moter, giving a speed to the latter, when carrying a heavy rider, of about eight miles an hour, and running for nine working hours with one charge at a cost of twopence per hour. The enormous advantages of this means of propulsion when applied to launches are at once apparent, abolishing, as it does, smoke, oil, smell, heat, and coal dust, and taking up but little space in comparison with a steam-engine, or with an electric engine worked by accumulators. The great nuisance and expense of being obliged, after a few hours' run, to go back to a charging station—as is the case with boats worked by accumulators—for a further supply of power, is totally obviated, as a launch fitted with this invention is a charging station of itself, and can even afford to charge other vessels of the accumulator type whose power has become exhausted. And we may here state that the inventor can carry his generator composition in the form of a paste, which, by merely mixing with water, forms at once a fresh charge for his batteries.

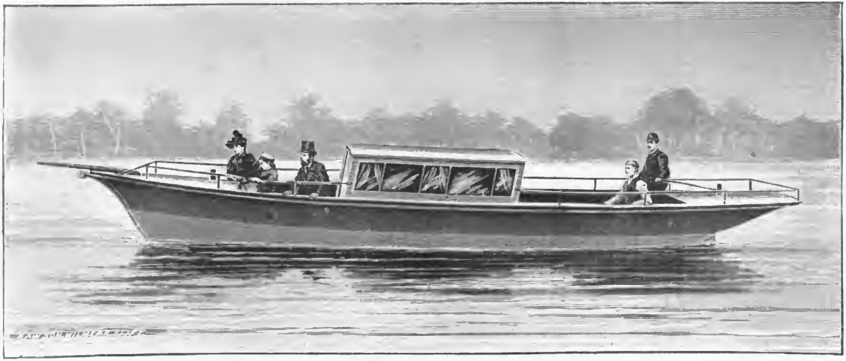
We have seen a launch, 40 ft. long, belonging to Mr. Sherrin, and fitted under his system with a capacity for a 600-mile continuous run. On stepping on board there is not the slightest indication of the power driving the propeller. The boat glides smoothly along without noise or vibration, there is no funnel, no smell, everything so clean and sweet that the most elegantly-draped lady might spend a week on board without soiling the hem of her garment. The deck and cabin spaces are entirely free from stem to stern, and, as we have said, not a trace of any propelling power is visible save the small box from which the still smaller handles of the regulating levers protrude. These can put on slow or full speed ahead and, with equal ease, the same astern. The motor is concealed under the deck at the stern, which is tastefully covered with floor-cloth, and the generating cells are enclosed under the seats in the same part of the vessel.

In the matter of cost, a launch of the same given size would, if fitted with steam, cost £400; if with the accumulator, £700; if with the "Sherrin," only £250. These figures speak for themselves.

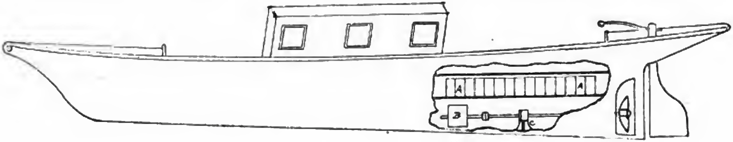
Another and a great advantage following the adoption of this system is that the vessel itself can, from the same motor producing the propelling power, be lighted up throughout, and a bilge pump be worked at the same time should that be necessary.

Our illustration No. 1 shows a launch fitted with the Vauhan-Sherrin Generator and Motor; and No. 2 a part section of same launch, showing arrangement of cells and motor and the mode of attaching the propeller shaft.

It is said that the knowledge of the powers and uses of electricity is yet in embryo. This we believe; but if we go on like this, we seem to have reached "the



No. 1.—Launch fitted with the Vauhan-Sherrin Generator and Motor.



A A. CELLS.
B. MOTOR.
C. THRUST BLOCK.

No 2.—Part section showing Cells, Motor, and mode of attaching propeller shaft.

parting of the ways," and an important landmark on the road to perfection. This invention of Mr. Sherrin's seems to open up a vista of things to come that may yet upset hitherto-accepted axioms, and while there is no doubt at present of the ability of his generator and motor to drive fans, clean knives, work punkahs, black boots, drive cycles, mow lawns, turn lathes, drive carriages, propel launches, and generally to perform on a moderate scale every application of power, may we not go some steps further?

Now that the problem of converting electricity into an actual power, without the intervention of accumulators and their attending engines, has become an actual fact, is it presumptuous to dream of the abolition of the steam engine? May we not in the near future see our *City of Paris's*, our *City of Romes*, our *Teutonics* and *Majestics* crossing the stormy Atlantic without the cumbersome boilers, the elaborate triple and quadruple expansion engines, and large bunkers? Who knows!

PROPELLERS.

A MEETING of the Institute of Marine Engineers was held in the Langthorne Rooms, Broadway, Stratford, on Tuesday, the 11th November, when Mr. Thomas Drewry, chief engineer Peninsular and Oriental Steam Navigation Co., read a paper on propellers.

The chair was occupied by Mr. F. W. Wymer, who introduced the author of the paper in a few appropriate words. The subject was divided into three portions: in the first part the paddle-wheel was referred to. The proportion of floats and of paddle-wheels was commented upon, also the advantages and disadvantages of side and stern wheel propellers. Next the screw propeller was touched upon and the pitch and form of screw relative to the fineness or otherwise of the vessel was pointed out as being one of the most important elements in connection with the designing of the driving machinery. The economy of bronze blades was shown as proved by results, and it was advocated that propeller blades, of whatever material, should be made as smooth as possible, in order to lessen the frictional resistance.

The corrosion or pitting action which takes place on the back of the blades was remarked upon, and the theories advanced to account for the action were discussed, and in closing, Mr. Drewry expressed the opinion that the pitting action found to take place on the backs of the blades was probably due to the air acting on the metal at the points where the velocity in feet per minute, at 60 to 70 revolutions, must be very great.

A very interesting discussion ensued, in which Messrs. R. Duncan, J. McF. Gray, J. R. Ruthven, G. Wiltshire, J. Adamson, R. Leslie, W. W. Wilson, the Chairman, and others took part, and in the course of which opinions were expressed as to several important details in connection with screw propellers. It was urged that the importance was not sufficiently realised of having the pitch of the blades exactly alike, not only in respect to the castings, but to their adjustment on the boss, as frequently the efficiency of a propeller was lowered owing to errors either in the casting or the adjustment. Cases were cited where a difference of over 12 in. was found to exist between four blades on the same boss. It was also pointed out that the adoption of bronze blades in place of cast-iron or steel was productive of economy in both speed and consumption of coal, and that this was partly due to the smoother surface of these blades. An example was given of a steamer with cast-iron blades, which were, after running for some time, made smooth on the surface, and gave very much greater efficiency. This was attributed to the smoothness of the blades, no alteration having been made otherwise in the machinery.

The opinion was generally expressed that the area of the blade should be so distributed as to leave the broadest part about one-fourth of the length from the root for an average, well-proportioned steamer. At the same time it was pointed out that engineers differed widely as to the best shape of blade to give the greatest efficiency, each builder having a peculiarity of his own. It was shown from cases cited that the alteration in the form of a blade might be attended with very advantageous results, as from the distribution of the area, by giving less surface at the point and more at from one-fourth to one-half up the blade, taken from the root. The question of how to deal with the "fitting" action was briefly discussed, and reference was made to several plans which had been patented or tried to stop the action, or at least, its result on the back of the blade.

Mr. Drewry replied, commenting on the remarks made in the course of the evening, and the proceedings closed with votes of thanks to the author of the paper and the Chairman, moved and seconded by Messrs. Sage and Harrup, and Messrs. Girvin and Simpson respectively.

The Honorary Secretary announced that Mr. Phillips' paper on "Iron and Steel Corrosion" was now published and ready for members, and that tickets and programmes for the conversazione to be held on Friday, the 5th December, might now be had on application.

LAUNCH OF H.M.S. "TERPSICHORE."

ON November 3rd this vessel was successfully launched from the shipyard of Messrs. James & George Thomson, Limited, Clydebank. The length of the ship is 300 ft.; breadth, 43 ft.; depth to the upper deck, 22 ft. 9 in. She will have a displacement of 3,400 tons with a mean draught of 16 ft. 6 in.

In a protected cruiser speed is of primary importance, and she will have a speed of from 18 to 20 knots. The propelling machinery consists of two sets of vertical inverted triple-expansion engines, which are supplied with steam at 155 lbs. pressure per square inch by five cylindrical steel boilers. The two propellers will be made of naval brass. In the important matter of coal supply, the ship will compare very favourably with those of a similar type. The coal supply at the load draught will be 400 tons, which will enable the vessel to steam at the ordinary cruising speed of 10 knots for a distance of 8,000 knots without coaling. The heaviest guns carried will be two 6 in. quick-firing guns, the one mounted on the forecastle and firing directly forward, the other mounted on the poop and firing directly aft. In addition there will be six 4 7 in. quick-firing 36-pounder guns of the well-known Elswick pattern, mounted three on each broadside. These guns are capable of firing about twelve shots per minute, and have a penetrative power equal to about 8 in. of iron armour. All these guns will be mounted on central pivot carriages. The supply of ammunition for these guns will be very large, as it is necessitated by the great rapidity of fire, so that the real power of the armament is greatly in excess of what might be anticipated by the consideration of the actual calibre of the guns. The auxiliary armament will consist of eight quick-firing 6-pounder Hotchkiss guns, one 3-pounder Hotchkiss, and four 5-barrelled Nordenfeldt guns. There are also four torpedo tubes, which are placed, one at the bow, another at the stern, and two others situated under the poop, which are capable of being trained through a very large arc of fire. The method of protecting the most vulnerable parts of the ship consists of a steel protective deck, which extends throughout the whole length of the ship, and is arched traversely, so that at the sides of the vessel it is about 4 ft. below the water, while at the centre of the ship it rises to a height of 1 ft. above the water. The thickness of this deck on the sloping side amidships is 2 in., while on the flat part the thickness is 1 in. Owing to the adoption of the vertical type of engine the tops of the cylinders project somewhat above the level of the protective deck, and in consequence it has been necessary to form an armoured breastwork around the cylinders, the sides of which are built up of compound steel armour plates 5 in. thick, with 7 in. of teak backing behind the plates. In order to localise any damage which may occur to the hull either above or below the protective deck, the hull is divided into a very large number of water tight compartments. The ship will also have a double bottom, as is shown by the midship section, which can be used for carrying water ballast, and is also a safeguard to the ship in the event of her touching the ground. The total number of water-tight compartments, including those in the double bottom, is eighty.

The ship will be steered by means of a balanced rudder actuated by a powerful steam steering engine situated immediately over the rudder and below the protective deck. The engine will be controlled by steering wheels in different parts of the ship, one of them being within the conning tower and another within the chart-house on the poop, from which she will be navigated under ordinary circumstances when not in action. In action the ship will, of course, be manœuvred from the conning tower, which is constructed of 8 in. steel plates, and within which are situated, besides the steering-wheel, a compass, the engine-room telegraphs, and a complete system of voice pipes with branches extending to the fighting stations of the guns, to the torpedo tubes and magazines, so that the ship is under the complete control of the commander in the conning tower. The total number of officers and crew carried will be 252, all told. The men will be berthed in roomy quarters in the lower deck forward, and the officers also on the lower deck, but at the after end of the ship. The commander will have a comfortable sleeping-room, as well as sitting-room situated under the poop. The ship will be lighted throughout by electricity, the installation being carried out by the newly-established electrical department at Clydebank; and she has been coated with Hartmann's Rahtjen's composition.

A NEW PROTECTED CRUISER FOR THE ARGENTINE GOVERNMENT.

THE latest example of the fast protected cruiser class of war-ship is a vessel of 3,200 tons, which is now receiving her armament at Elswick, and has been constructed by Sir W. G. Armstrong, Mitchell, & Co. for the Argentine Government. On the results of the steam trials of this vessel, which have been completed, it is claimed for her that she is the fastest vessel afloat. She has been named the *25 de Mayo*, to commemorate the date of the independence of the Republic. She is 325 ft. long, 43 ft. broad, and 16 ft. mean draught. Her armament consists of two 21 cm. breech-loading guns, eight 12 cm. quick-firing guns, 12 3 pr. quick-firing guns, and 12 1 pr. quick-firing guns, all of Elswick make. She is also armed with three 18 in. above-water torpedo guns. Her engines and boilers, which are wholly beneath the water line, have been constructed by Messrs. Humphrys, Tennant & Co., of Deptford Pier, London. She has two sets of vertical four-cylinder engines, each in a separate water-tight compartment and working independent screws. The machinery, magazines, and all the vital parts of the ship are protected by a strong armour deck with sloping sides, extending the whole length of the vessel. The armour on the slopes varies from 3⅛ in. to 4½ in. thick, and the flat portions of the armour deck are 1¾ in. thick. Above the armour deck, also extending the whole length of the vessel, is a raft body, which is 3 ft. deep along the midship portion, and of greater depth towards the extremities, where the armour deck slopes downwards. Along the sides of the ship throughout the machinery spaces coal bunkers are constructed so as to form a continuation of the raft body, and these and the raft body are divided into numerous water-tight compartments. In other respects the vessel is similar to the fast cruisers constructed, or in course of construction, for the British Navy, except that in the *25 de Mayo* there is no inner bottom under the boiler compartments. The ship has a bunker capacity of 600 tons of coal, but her normal supply is 300 tons. In the course of the steam trials, which have now been completed, under the superintendence of the Argentine Commission at present in this country, numerous runs on the measured mile at various speeds were made, and a curve of performance in terms of revolutions of screws was constructed. The trials included a run of six hours' duration with natural draught, and the mean speed during this time, based upon the curve of performance and checked by a number of runs on the measured mile with and against the tide during the six hours, was 21·237 knots, and the mean power developed was nearly 9,000 horses. With forced draught and a pressure in the stokeholds not exceeding that corresponding to a head of 2 in. of water, the mean speed with and against the tide was 22·43 knots and the power about 13,800 horses. The official forced-draught trials were made at the close of the day, after the six hours' natural draught trial had been completed, and the result was therefore particularly gratifying as indicating that a still higher speed might have been obtained under more favourable conditions; but the Argentine Commission attach much greater importance to the natural-draught trial, which could be relied on and maintained for any desired time, than to an exceptional result with forced draught, which could only be maintained for a few hours.

The machinery throughout the day worked admirably and without a hitch of any kind. Sir W. G. Armstrong, Mitchell & Co. have in this vessel even exceeded the results obtained in the Italian cruiser *Piemonte*, which left our waters about 18 months ago.

THE TREATMENT AND UTILISATION OF EXHAUST STEAM.

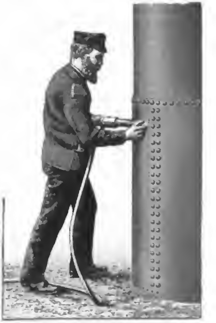
AT a meeting of the Society of Engineers, held at the Town Hall, Westminster, on Monday evening, the 3rd November, Mr. Henry Adams, president, in the chair, a paper was read by Mr. Percy Griffith, on "The Treatment and Utilisation of Exhaust Steam." The author first pointed out that the economical value of exhaust steam is very great, but that in spite of the many systems for utilising it, little advantage is taken of such value, owing probably to the absence of information on the subject. He then called attention to the three general uses to which exhaust steam may be put:—1st. For heating water; 2nd. For condensation to form a vacuum; and 3rd. For evaporation of liquids or juices. Treating first of water heating, he proceeded to detail the advantages of heating the feed water to boilers, showing that the maximum fuel economy obtainable by so doing was about 16 per cent., but that other collateral advantages were together often of greater importance than that of fuel economy, such as the greater safety and lengthened life of the boiler, due to the absence of scale; absence of leakages and frequent repairs, due to the greater uniformity of temperature in the boiler, and finally the increased power of the boiler itself. A few suggestions were made as to the selection of a heater and keeping the tubes free from scale. Reference was then made to the Dudley heater, Rayner's heater, the "Compactum" exhaust heater, and to Wright's improved Berryman heater. A special feature of the last named is a grease-extracting apparatus, which enables the condensed steam water to be used for boiler feeding, this water being much more suitable than fresh water owing to its purity and softness. The author then referred to the "Compactum" live steam heater, and remarked that the economy derived in practice from this system contradicted the theory that no advantage could be derived from taking live steam from the boiler for feed-heating, and he pointed out that the economy was probably due to the additional purification of the water under the higher temperature. Weir's heater was then described, and the system of using steam taken from the receiver of the engine to heat the feed water was briefly referred to. Returning to the uses of exhaust steam, the author referred to its applicability to heating water for baths, lavatories, or for heating buildings, pointing out that in many cases it would be economical to dispense with a vacuum in the engines in order to obtain exhaust steam for these purposes. In connection with the use of exhaust steam for condensing, a brief reference was made to Wright's condenser, which was described, and its several advantages were pointed out, after which the use of exhaust steam for evaporation was entered upon. Messrs. Kirkaldy's, Messrs. Caird & Rayner's, and the "Yaryan" evaporators were described, these using steam taken from the boiler, also Weir's evaporator, taking steam from the receiver of the engine and passing the vapour either to the low-pressure receiver or to the condenser. It was pointed out that the chief use of evaporators was to produce make-up feed water where condensing engines were employed. The author then illustrated and described a combination of apparatus patented by Mr. Wright, in which, while the steam from the main engines is condensed in a surface condenser the steam from auxiliary or electric light engines is used for heating the feed water, the surplus being passed into an evaporator for producing the make-up feed water. The condensed steam in each case is collected, purified, and used as feed water. The author, in conclusion, described an apparatus made by Messrs. John Kirkaldy, Limited. This, he pointed out, was very similar to the combination which he had already described as patented by Mr. Joseph Wright, the exhaust steam from auxiliary engines being utilized for evaporating the make-up feed and for heating the feed water in connection with main condensing engines. After explaining the working of the combined apparatus the author called attention to one or two doubtful points in connection with the application of it to practical working.

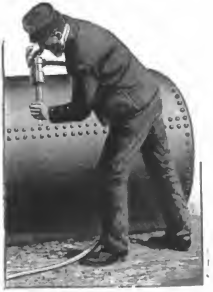
THE ARGENTINE TORPEDO BOAT "BATHURST."

THE Argentine Government has of late added to its navy 14 torpedo boats, six being of the first-class and eight of the second-class type. The first-class boats are 130 ft. long by 13 ft. 6 in. beam at water line. Five of them are fitted with triple-expansion engines, and on their official trial developed a mean speed of 23·312 knots. The last of these six boats has been fitted by Messrs. Yarrow, of Poplar—who have constructed the whole of the 14 vessels—with quadruple-expansion engines with the view of testing the comparative merits of this type of machinery. The internal arrangement of these boats is very similar to that of the torpedo boats last built by the same firm for the British Government. There are 11 water-tight compartments, and the skin plating of the hull is mild steel galvanized, but of greater thickness than is usual in this class of vessel. The fore part is protected by a turtle back, and the conning tower contains the steering wheel, which can be worked either by steam or by hand. The boilers in all of the Argentine torpedo boats are of the locomotive type, with copper fire-boxes and brass tubes. These boats are fitted with Yarrow's water-tight ashpan arrangement, which prevents the fire being extinguished by a sudden inrush of water from damage to the hull. The armament of the *Bathurst*—for this is the name of the boat under notice—consists of one 18 in. bow torpodo tube for direct-ahead fire; two 18 in. tubes, placed aft, for side discharge; two 3-pounder quick-firing guns, and one double-barrelled 1 in. Nordenfeldt gun. The chief point of interest in the *Bathurst* is the introduction of quadruple-expansion engines, which have four inverted cylinders acting on four cranks on one shaft. The cylinders are respectively 14 in., 20 in., 27 in., and 36 in. diameter, by 16 in. stroke. The engines are placed in pairs, each pair having its cranks opposite one another, which arrangement balances the moving parts and reduces the vibration of the vessel. The official trial of the *Bathurst* took place on Thursday, November 13th, there being on board Captain Spurr and Captain Garcia, representing the Argentine Commission, and Mr. Hughes, the engineer to the Commission. The trials were in charge of Mr. Krohn, representing Messrs. Yarrow. The vessel left Poplar soon after 11 a.m. and returned about 5 p.m., during which time she made six runs on the measured mile and a continuous run of two hours at full speed. The results were an average speed of 24·453 knots on the measured mile runs, and an average speed of 24·4 knots on the two hours' continuous run. The average number of revolutions on the measured mile runs was 433 per minute, and on the two hours' run 432 per minute, the average steam pressure being 199 lbs. The average I.H.P. of the five first-class boats with triple-expansion engines was found to be 1,120. The quadruple-expansion engines of the *Bathurst* developed 1,230 I.H.P., showing a gain of 110 H.P., the consumption of fuel being the same. The trial of the *Bathurst* was in every respect satisfactory, as in the previous vessels, the manœuvring power being excellent. The *Bathurst* is stated to be the fastest boat for its dimensions ever built, and for a fighting ship it is of the first importance to keep the dimensions down as much as is practicable so as to expose the smallest area of target to the fire of the enemy. The small amount of vibration in this boat at cruising speeds as compared with that in many others is very noticeable, and is a point of importance as affecting the health of the crew, prolonged exposure to vibration having been found to produce nervous exhaustion.

THE PATENT PNEUMATIC CAULKING TOOL.

QUITE apart from the question of superior efficiency, any machine tool designed to effect automatically those classes of manual labour which make little or no demand on the intelligence of the worker, is worthy of attention and adoption. Caulking plate edges and butts in ships' hulls and boilers is certainly work of this class; and a tool which seems well to overtake its execution expeditiously, efficiently, and without a tithe of the usual expenditure of manual force, is now being introduced by the makers, the well-known firm of Crossley Bros., of Openshaw, Manchester. This is the Patent Pneumatic Caulking Tool, of which we are enabled herewith to give two views, showing the tool as applied to the work to be done. Briefly, the tool consists of a cylindrical case in which works a piston that reciprocates to and fro. At one end of the stroke the piston strikes the caulking tool and at the other it is cushioned by compressed air, which drives it. For the tool shown—the heavy caulking tool—a pressure of 60 lbs. and about 50 ft. of air per minute are required; and with this, as motive power, about 3 ft. of caulking may be done in the most satisfactory manner *per minute;* the motion of the caulking tool being rapid and steady, giving sharp, uniform blows. It will be obvious from this description that the tool is adopted also for the work of chipping; a species of work indeed for which it has been found most efficient. It is now at work in a number of marine boiler shops throughout the kingdom, including Messrs. D. & W. Henderson, of Partick,



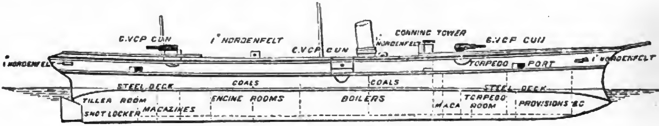


Glasgow; Messrs. Blair & Co., Stockton-on-Tees; also on stationary boiler work at Mr. Beeley's, of Hyde. In addition, there are some thirty to forty of the best known shipbuilding and boiler-making firms in this country at present experimenting with it. In several of the yards on the Clyde, the tool is giving satisfaction and saving much labour. In fact, on straight work, one of these tools is found capable of doing as much work as six men caulking by hand.

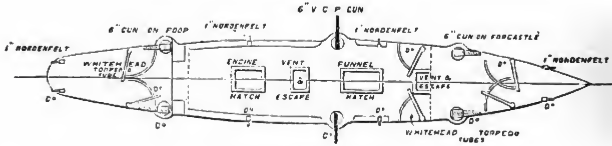
NAVAL NOTES.

The Loss of H.M.S. "Serpent."

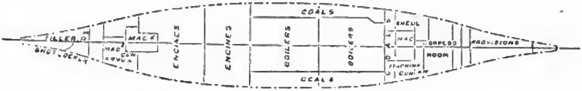
NOT for many years has the country been visited by such a terrible naval calamity as the loss of H.M.S. *Serpent*, which occurred on the night of the 10th ult., near the small town of Camarinas on the north-west coast of Spain. The *Serpent* was a new vessel, and belonged to a class popularly known as the *Archer* type of torpedo cruiser, and with her sister vessel the *Racoon* differed only from the others of her kind in having more powerful engines. She was designed by Sir Nathaniel Burnaby, late Director of Naval Construction, during the Administration of Lord Northbrook as First Lord of the Admiralty. Her first steel plate was laid at Devonport on November 9th, 1885; she was launched on March 10th, 1887; and completed the following year. Fine lines terminating forward in an imposing ram were the primary features of the design, and as speed and coal endurance were aimed at, lightness of scantling, combined with strength, was the chief embodiment in her construction.



H.M. TORPEDO CRUISER SERPENT.—SECTION.



PLAN OF UPPER WORKS.



PLAN OF HOLD.

The *Serpent* was a third class twin-screw cruiser and built of steel throughout to the following dimensions:—Length between perpendiculars, 225 ft., breadth extreme, 36 ft., draught of water, 13 ft. 6 in., and displacement 1,700 tons. She was fitted with two sets of engines constructed by Messrs. Harland & Wolff, of Belfast, capable of developing collectively upwards of 4,500 I.H.P. The total cost of the hull, engines, and armament amounted to about £120,000. In July last she was commissioned with a complement of 176 officers and men, for service on the West Coast of Africa, and was on her way thither to take up her station when she struck, while steaming at a little more than half speed, on the Punta Buoy reef near Camarinas, and foundered with a loss of 173 valuable lives. The primary cause of the terrible disaster, as far as the information which has been elicited from the three survivors goes, was that the vessel was considerably out of her proper course, and not as has been alleged through compass errors, or defects in her propelling machinery, or even unseaworthiness. Unhappily she was steered upon the rocks and confronted a danger which the staunchest and strongest built ship could not have survived. As showing the confidence which the Admiralty have in the seaworthiness and stability of this class of vessel they have directed the *Mohawk* to be commissioned forthwith to take the place of her late sister vessel the *Serpent*.

One of the many effects which may be expected to flow from this calamity will be the keen attention and criticism bestowed upon the class of war ships of which the *Serpent* was a member. In view of this, some particulars as to the construction and sea-going qualities of the *Serpent* and others of her class will be of interest. In the *Serpent* the skin plating did not cover the edge of the protective deck, and during the naval tactics of 1888 certain leaks were revealed in this region, but a subsequent overhaul and re-caulking in wake of the protective steel deck effectually put a stop to this evil. In later vessels the outside plating is made to overlap the edge of the protective deck, and Messrs. J. and G. Thomson, of Clydebank, have recently introduced a belt of chrome steel for this purpose in the construction of the Japanese cruiser *Chiyoda*. It has already been stated that the *Serpent* was built of light scantlings. While viewed as a structure apart from the armament which she was made to carry, she was of ample strength, still in view of the catastrophe and of what has all along been maintained regarding her being overweighted by guns, there is little room left for doubt as to her having been unfitted for service in rough seas. Lord Brassey says, in his Naval Annual: "It must be admitted that these vessels have faults common to many smaller cruisers of modern design. In the construction of the hulls economy of weight has been carried to excess. The plating is too thin for durability; the armament is overdone. In a sea-way the heavy top weight causes loss of speed, and throws an undue strain upon the light structure upon which it is placed."

Boats of this class undoubtedly possess the undesirable quality of rolling in a lively manner, and on account of their fine extremities, with the ponderous weights carried forward, they pitch heavily in a sea-way. For these reasons they are unable to maintain their speed in anything approaching a heavy sea. The general disposition and weight of the armament has been referred to by some critics as being conducive to rolling in this type of vessel, and for her size the *Serpent* was one of the most heavily-armed vessels afloat. She mounted six 6-inch breech-loading central pivot guns on Vavasseur carriages; eight 3-pounder quick-firing guns, two Nordenfeldt machine guns, and one 7-pounder gun. In addition, she was fitted with five Whitehead torpedo tubes, each 14 in. diameter, one being situated directly in the bow, one on each broadside, and one on each quarter.

With regard to speed matters the *Serpent* was not altogether a brilliant success, and in this respect she cannot be said to have realised the wishes and intentions of her designers. The official speed of 17·5 knots was rarely if ever reached without considerable apprehension on the part of her engine-room staff, and her early trial trips were characterised by repeated failures and breakdowns. Even as late as July last, when on her commissioning trial, the cover of the high-pressure cylinder of the port engine cracked, which necessitated a retreat to the dockyard for repairs. She subsequently however went through a satisfactory three hours' trial under forced draught, and attained a speed of 14·12 knots with 2,512 I.H.P.; the revolutions being 129·35, and the air pressure in the stokehold ·37 of an inch of water. In her early trial trips, perhaps one of the best took place in May, 1888. On that occasion, while on a four hours' run at a mean draught of water of 13 ft. 6in., the patent log registered a speed of 16 knots, with the engines developing collectively 4,059 I.H.P. In official statements and figures the *Serpent* and the *Racoon* are credited with speeds of 17·5 knots, while the remaining six of the *Archer* type are set down as 17-knot ships. It is true that the *Archer* and *Brisk* have reached speeds of 17·3 and 17·6 knots respectively on the measured mile when forced, but their performances in actual service under normal conditions of weather, &c., are considerably at variance with these results.

The coal capacity of the *Serpent* was 475 tons, and with this quantity it was officially averred that she could steam a distance of 7,000 knots at a speed of 10 knots. But here again there is a huge discrepancy between what she actually could do and the paper statements. In the naval tactics of August last, after steaming a distance of about 3,600 knots, at a 9-knot speed, with the hostile fleet under command of Vice-Admiral Sir Michael Culme-Seymour, she returned to Torbay with just enough coal in her bunkers to do other 250 knots at a 10-knot speed!

The New United States Battleship "Maine."

It cannot be denied that the navy of the United States is making rapid strides towards taking a creditable position among the leading navies of the world, and the launch of the new armoured battleship *Maine* from the Brooklyn Navy Yard, on the 18th November, has added a most powerful unit to the United States fleet of turret ships. The *Maine* is the largest armoured ship yet constructed in the States, and from the American standpoint great things are expected of her. She was launched amid much enthusiasm, the christening ceremony being performed by Secretary Tracey's niece. The leading particulars of the vessel are as follows:—Length between perpendiculars, 310 ft.; breadth, 57 ft.; mean draught of water, 21 ft. 6 in.; and displacement, 6,650 tons. The propelling machinery will consist of two sets of triple-expansion engines capable of developing collectively 8,750 I.H.P., with which it is expected to realize a speed of 17 knots. Her armament will be of the most powerful description, and will include four 10-in. 26-ton breech-loading guns, six 6-in. breech-loading guns, four 6-pounders, and eighteen machine guns. In addition, she is pierced for seven torpedo tubes.

The Speed Trials of the New U.S. Cruisers.

The business of reconstructing the United States Navy goes on apace, and popular interest in its welfare and progress grows daily, as each new cruiser is launched or run over the measured distance for trials of speed. Enthusiasm ran high a few weeks ago over the results achieved by the *Philadelphia*, a steel cruiser of 4,324 tons, when on a four hours' run off the Long Island coast she exceeded her estimated speed of 19 knots by ·68 of a knot. This enthusiasm, however, had scarcely died away when the performance of the *Philadelphia* was eclipsed by that of the *San Francisco*, of 4,083 tons. On a four hours' run in Santa Barbara Channel the latter vessel realised a speed of 19·72 knots. This performance, good as it is, has been surpassed still more recently by the *Newark*, a sister ship to the *San Francisco*, built by Messrs. Cramp & Son. During an unofficial trial of four hours' duration a speed of 20 knots was obtained with 126 revolutions, the engines indicating 9,000 H.P. A creditable performance of the newly-constructed gunboat, *Concord*, also falls to be recorded. This vessel has a displacement of 1,700 tons, and is fitted with engines of 3,400 H.P., and during an official trial, which took place on November 19th, a speed of over 17 knots was averaged during a run of four hours.

Loss of an Italian Torpedo Boat.

The torpedo flotilla of the Royal Italian Navy has sustained a serious loss through the foundering of torpedo boat No. 105. She was one of a class of fourteen single screw boats, built by Herr F. Schichau, of Elbing, Prussia, which have given general satisfaction to the Italian Naval authorities. The particulars of the vessel are as follows:—Length, 128 ft.; breadth, 15·8 ft., and mean draught, 6 ft. 9 in.; with a displacement of 84 tons. She had a coal capacity of 18 tons, and was fitted with engines of 1,000 H.P., with which a speed of 22 knots had been realised. Vice-Admiral Rooera Di Maria, commander of the permanent squadron, is considered responsible for the loss of this vessel, and will be tried by the Superior Tribunal of War at Venice.

SPECIALLY DESIGNED STEAMER FOR THE CATTLE TRADE.

THE enormous development during the last few years in the shipment of live cattle from America and the the Colonies has necessitated increased attention being paid to the construction of vessels specially designed for this class of trade, and Messrs Laird Bros., of Liverpool, have just completed for the Atlantic Steam Navigation Co. the s.s. *Ottoman*, which may be taken as the most improved and modern type of steamer that has yet been designed for carrying cattle across the Atlantic. Through the kindness of Messrs. Laird we had an opportunity of making a complete inspection of the *Ottoman* whilst lying in the dock, prior to her official trials, which have taken place during the past month, and a description of the vessel will be of interest. The *Ottoman* is a steamer 402 ft. in length between perpendiculars, 45 ft. 6 in. beam, and 36 ft. 6 in. in depth. She is built of steel with a cellular bottom for water ballast, of which she can carry 1,100 tons. The scantlings are to Lloyd's highest class, but in addition she is specially strengthened by means of longitudinal girders and stringers. She has no keel, but the internal keel plate is continued up and divides the double bottom into separate water-tight compartments which greatly facilitate running the vessel. The skin-plating and framing are of the usual type, but the three upper shakes of plating, including the sheer shake, have double hull clasps. There are two large bilge keels, 16 in. deep, extending about two-thirds of the length. The vessel is divided into eight water-tight compartments by seven bulkheads, which extend from the wheel to the upper deck. These bulkheads are additionally stiffened when necessary. There are four decks, the upper and main deck being plated all over and sheathed with iron, the lower deck being plated over for about two-thirds the length of the vessel and also sheathed and an orlop deck. On the upper deck is the topgallant forecastle, a long midship bridge house and a full poop. The bulwarks are about 4 ft. 8 in. high, and extend from the forecastle and from this to the poop. To the bulwarks, which form part of the permanent structure of the vessel, are riveted at intervals of about 4 ft. angle bars of large section, which carry the beams for the awning deck. To these angle bars or continuation frames is bolted the wooden skin of 3-inch planks, tongued and joined. On the beams afore-mentioned is laid a properly fitted awning deck, which extends from the forecastle deck to the bridge deck, and from the after part of the latter to the poop, thus the upper deck is completely closed in by a most substantial awning deck, under which cattle can be carried. This deck is 8 ft. high and has large spacious hatches for ventilation. Owing to the great freeboard of the *Ottoman* these hatches will never require to be closed, as even when water is taken over the bows it is prevented from running aft by a deep manger extending across the forecastle. This awning deck, too, is properly railed in and forms a perfectly safe working deck, and large iron doors are fitted in the bulwarks for the admission of cattle. The hatches of the upper deck are fitted with inclined gangways, so that the cattle can be readily taken to or from the lower decks. Under the poop is the steering engine, by Harrison, of Manchester, which is of an extremely good design, and is a decided improvement on previous practice. The rudder is formed of a cast steel frame, with a central plate, and the spindle is joined to the rudder frame by a coupling. On the rudder-head is a large wrought-iron circular frame, which carries the steering chains, and is also fitted with a brake. The steering chains are led to a vertical band, on the shaft of which is keyed a cast-steel worm wheel. The steering-engine runs a shaft carrying a worm, which gears into this; by this arrangement the engine is entirely relieved of any strain, while the motion is very quick. On the forecastle head is a full size Emerson, Walker & Thompson's windlass, driven direct, the engine also driving by shafting and bevel gearing a large capstan. The anchors, of Wasteneys Smith's stockless type, stow up the hawse pipes. The engines consist of a set of tri-compound vertical engines, the cylinders being 31 in., 50 in. and 78 in. in diameter by 5 ft. stroke. They are carried in massive cast-iron box columns. Piston valves are used for the high-pressure and intermediate pressure engines, and an ordinary D valve for the low-pressure engine. All the valves are balanced. The crank-shaft, thrust-shaft, and propeller-shaft are of steel, as are also the piston rods, connecting rods, &c. All the wearing surfaces are of very large proportions, and there is a noted absence of anything like a sacrifice of weight to save displacement. An excess of strength in the ship and engines is only in keeping with Messrs. Laird's well-known practice. The engines, in fact, give one the impression of being a first-class substantial and simple job. The main condenser is situated behind the columns; behind this is a compound Tangye engine, which drives a Tangye circulating pump. The air-pump, bilge, and feed pumps are driven off the L.P. crossheads. Among other smaller engines are Weir's feed-heater and pumps; Hocking & Son's climax condenser; Alley & MacLellan's ash-hoist; and the bilge, ballast and fire pumps are by Carrick & Wardell. There is also a subsidiary condenser in the engine-room, in which all the drainings from the steam winches and small engines are collected. A small Tangye centrifugal pump circulates the cooling water, and the condensed steam goes to the hot-water tank. The engine-room is very large and roomy, there being abundance of space for storerooms, &c. Steam is supplied from three double-ended boilers with eighteen furnaces, with Purvis's ribbed flues. The working pressure is 150 lbs. per square inch. There is also a single-ended donkey boiler. The boiler power is very great, and more than ample for the needs of the ship. The propeller is left-handed, and is 18 ft. in diameter, with a pitch of 21 ft.; the boss is of steel, and the blades of manganese bronze. Amongst other fittings are Basnett's engine-room and compass telegraphs, Sir W. Thompson's compasses and sounding machines, Sewell compasses and instruments of navigation, Brown and Co.'s improved Coult's and Adamson's governor, and Wilson cooking range for the galley. Under the forecastle deck are the petty officer's, seamen, and firemen's quarters, the accommodation provided being unusually good. The baths, washhouses, w.c.'s, &c., are all that can be desired, and in many ways the comfort of the crew has been carefully studied. For working cargo there are five very large steam winches by Clarke, Chapm Co. The barrels are about 2 ft. in diameter, and are rtical open gear, thus rapidity in hoisting is a ficers' and engineers' quarters are amidships, well furnished. Steam heaters are fitted to hout the ship, and everything that can conduce to the comfort of the officers and men has been amply provided. The cattle-men's quarters are in the poop, and are of a very superior character indeed. The captain's state room and saloon are well-furnished, comfortable apartments. The chart-room on the bridge is a very spacious apartment and well lighted. On the upper bridge is the steering and pilot house. The *Ottoman* has four masts and one funnel. The lower masts are very short, and carry folded top masts so as to permit her to pass under the bridges crossing the Manchester Ship Canal. The foremast carries a large spread of square canvas; the other masts, fore and aft, sail. The ship is lit throughout by electricity, there being a very fine installation by Messrs. Charlesworth, Hall & Co., of Oldham. As might be expected the cattle fittings are of the latest and most improved type, and received the special attention of Messrs. Laird and Mr. James S. Thomas, the marine superintendent of the British and North Atlantic Steamship Co. The *Ottoman* can carry no less than 1,040 head of cattle, besides a number of sheep. The arrangements for feeding and watering and ventilating are very complete, water being laid on *ad lib.*, numerous upcast and downcast air shafts; large air trunks, extending from the lower deck to the bridge deck, provide for ventilation. On the bridge deck is a very large tank for supplying water to the w.c's., bath houses, &c. In all the cargo and cattle spaces steam fire extinguishers are fitted, worked from the awning deck. This with the very large amount of pumping power would enable a fire to be dealt with on something like equal terms. In the official trials a series of runs were made between the Bar and the North-West lightship outside the Mersey. The *Ottoman* was in the light condition, the propeller not being fully immersed; consequently the results obtained are hardly a correct estimation of the capabilities of the vessel. The mean draft was 17 ft. 7½ in., and the correspondent displacement about 5,900 tons, with a boiler pressure of about 150 lbs. per square inch, and the engines making 70 revolutions per minute, the mean speed was 13·9 knots. The mean I.H.P. was 3,012. These results were in excess of those specified, and bearing in mind that the *Ottoman* has a large co-efficient of fineness it will be seen that the speed attained is comparatively high. When fully laden she will maintain a mean ocean speed of 12½ knots. The trial was eminently satisfactory, and considering that it was the first time she had been under steam, it speaks highly of the care shown in the adjustment of the engines. After a very satisfactory run the owners' representatives declared themselves thoroughly satisfied with the vessel, and we have no doubt that she will maintain the reputation of her owners and builders.

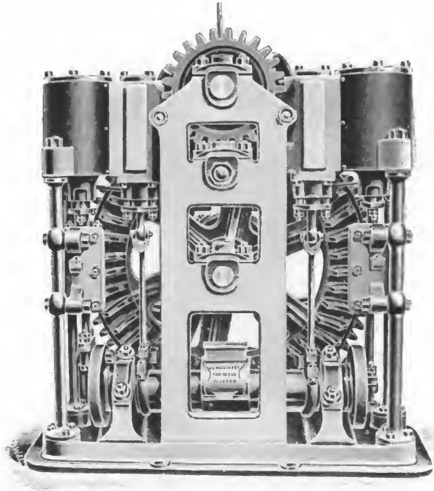
PATENT LION METALLIC PACKING.—Messrs. James Walker & Co., of 4, America Square, Minories, London, E.C., introduced this packing some time ago, and have since then met with most flattering testimonials as to its utility from the engineers of the leading steamship companies, who have had experience in its use. It is specially designed and constructed for use in triple-expansion and high-pressure engines, as well as hydraulic pumps, and is made of indestructible elastic material of metallic combination, and by its formation is free to expand by heat or steam. It presents a metallic face to the rod, reducing friction, and enduring wear. The packing is made in a spiral form, in all sizes from ¼ in. upwards, and the studs used in its construction are compounded of the best lubricating metal.

INSTITUTE OF MARINE ENGINEERS.—Arrangements for the conversazione (the second of this young but flourishing Institute) which takes place on Friday, the 5th inst., in the Town Hall, Stratford, are now completed. A varied, attractive, and admirably arranged programme has been issued, which promises to be highly interesting and enjoyable. A loan collection of exhibits, contributed by members and friends, of subjects relating to marine engineering, as well as gifts presented to the Institute, are to be on view during the evening. We have no doubt that, from the abilities of the young ladies and gentlemen whose names appear in the programme, a thoroughly good concert may be expected, and we look forward to a good half-hour in the ante-room with our esteemed friend Mr. McFarlane Gray, of the Board of Trade, who presides at the phonograph. Tickets can only, we believe, be obtained by an introduction from a member, and we have no doubt that any sea-going engineers, who happen to be on shore, will avail themselves of this opportunity of varying their somewhat monotonous sea life by attending this "gathering of the clan."

NEW AND IMPROVED STEERING GEAR.

ON this and page 378 we illustrate a new type of steam steering gear now being introduced by Messrs. R. C. Wallace & Co., engineers, Queen's Dock, Glasgow, who are the sole manufacturers. This steering gear embodies several features of interest from an economical and efficiency point of view.

As will be seen from our illustrations, it is designed for working by steam alone, or by steam and hand combined, the change from steam to hand being easily and most expeditiously effected. One good point in this gear is that it can be changed from steam to hand when the rudder is in any position; the indicator on the column is always indicating when steering by hand just the same as when steering by steam.



A unique and most important feature of this steering gear is the worm wheel with which it is fitted—the patent of Messrs. Campbell & McCallum. The teeth of this wheel are movable and accurately secured and geared into the worm shaft. They oscillate, and adapt themselves to the proper angle for contact with the worm. While this is so, however, the surface in actual contact is more extensive and the power greater in this form of worm-wheel than in those of the ordinary description. The teeth are carefully made of the best gun-metal or other suitable material. In the event of any tooth breaking this can at once, and with the greatest ease, be replaced from the spare stock on board. The advantages of this wheel are obvious as the breaking of every second tooth does not cripple the steering engine or incur the expense of a new wheel, as would be the case if an ordinary cast-iron wheel were used.

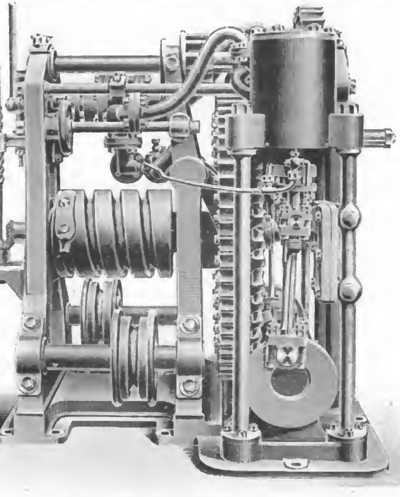
The gear is controlled in the wheel-house, or on the bridge as may be required, the arrangement of the control valve adopted being such as to render control a matter of the greatest ease and sensitiveness. One-eighth turn of the controlling wheel puts the rudder hard-a-port to hard-a-starboard in a few seconds. A great advantage of this control valve consists in the fact that it can be opened and closed just sufficient to give the engine a quarter-turn only. When closed the steam and exhaust ports close at the same time, so that the engine stops at once. The exhaust port being closed, no steam can pass through the engine when it is not in motion. This gear has already been fitted to several vessels built on the Clyde, and is giving every satisfaction; the general consensus of opinion being that it is one of the finest in the market.

Foreign-built Vessels for France.—The French Customs returns show that foreign-built steamers, to the amount of 29,471 tons, and sailing vessels, measuring 18,285 tons, were registered in France during the first nine months of this year. This is nearly double the quantity built in France during the same period. Foreign-built ships registered in France after January 29th next will have no claim to the navigation bounty.

AMERICA AND THE IRON AND STEEL INSTITUTE.

THE recent visit of the Iron and Steel Institute to the United States and Canada marks an important epoch in the scientific world. The representatives of two of the greatest nations have met together and had opportunities of comparing notes of processes in such a manner—the essentials of which could probably only be provided by the Americans alone—that the unity between the individual and the nation has become intensified and strengthened. There are two ways in which nation may visit nation. In one, the spirit of criticism, of envy and of disaffection may colour the proceedings; in the other a fraternal sympathy and mutual desire for progression may be the tone of the visit. The latter has characterized the appearance of Englishmen on the other side of the Atlantic. There are, likewise, two methods in which the visitors may be received, the one that of suspicion and lukewarmness, the other of earnest cordiality and hospitality, which latter was the relationship in which our American brothers greeted the arrival of the English scientists and manufacturers to their own shores. To pay a verbal tribute to the lavish kindness and openhandedness which inspired the thoughts and actions of the people of America to extend such a hearty and continued welcome to our ironmasters and those who accompanied them, is but a meagre way of expressing one's appreciation of the fact; for it is one that can only be balanced by reciprocity. The visit of so many experts to this vast iron-laden country undoubtedly impressed their minds to a far greater degree than a hundred books of statistics, of the prospective competition stored away in the yet undeveloped mines, could have accomplished. And still more must the almost phenomenal celerity with which the manufactures of iron and steel were turned out from the works have provided them food for reflection—with vast resources; with such great achievements in the past, and promises of greater successes in the future; with a pig-iron plant capable of producing 800,000 tons a year, and a steel works with capacities of turning out 1,300 tons of ingots, or over a thousand tons of rails per day, the manufacturers of the United Kingdom have not a path before them entirely free from obstacles in the way of competition.

Another great factor in the industrial development of any country prevails too in the States, namely, cheap and facile transport of materials, necessarily effecting a low price in the market. One or two of these items are those in which our own country fail, though probably in other ways her conditions are superior. One thing, however, that the Americans apparently are weak in is economy. So long as a large yield is produced and the smallest possible time is occupied in its accomplishment, all else is subsidiary. But the economic laws will not be infringed with impunity without a reactionary movement at some time or another setting in. This is best known, however, to their own people. They know to a close approximation their own resources, they are cognisant of the requirements of the markets, and the best means probably of meeting them, but should their prognostications prove abortive the result would be beyond conception. Their idea may be that presently, after reaching the height of their ambition, they will be abl "to take it easy."



Steam Steering Gear.—*For description see p.* 377.

The subsequent visit of the Institute also to the Dominion of Canada, has probably opened the eyes of those who have previously had no other basis for their knowledge than statistics. Canada has ever been recognised as one of the most thriving and most productive of Great Britain's attaches which have lacked the means of further development because of the absence of adequate transportation facilities. This, of course, is naturally an enormous disadvantage under which to labour, for without ready transport there cannot possibly exist any activity. Canada, with an area of 3½ million square miles, possesses under 15 thousand miles of railroad, whilst British India, which is regarded as a sample of neglect in this respect has with a far smaller area, a much larger mileage of railroad in proportion. Canada seems to be a reflection, and a very bright one, of the great and wealthy States, and possessing in all points even more than her neighbours. The metal nickel is apparently concealed in the sub-strata of Canadian soil in enormous quantities. Mr. E. Wiman, speaking to the members congregated at the Niagara Falls, says, "Who could, for instance, have imagined until within the last few months that Canada possessed within herself the potentialities for the defence of the world? Yet the visit just made by the Iron and Steel Institute to the Sudbury copper-bearing regions, which are only twelve hours from Niagara, discloses the fact that her deposits of nickel were the greatest the world has ever seen. Now it has recently been discovered by tests of the United States navy that nickel-plated armour for ships, or steel alloyed with nickel, is practically impenetrable, alongside which the boasted British armoured plates crumbled into nothingness for defensive purposes." This is saying a very great deal, and has yet to be corroborated by practical evidence. Nickel is a comparatively modern metal as far as its utilisation goes, for it was not until 1876 that some specimens of wrought and forged nickel were shown at the Philadelphia Exhibition. Alloys of iron and nickel were made by several well-known metallurgists, among them are Mr. J. F. Hall, Mr. Marbeau, Dr. Percy, and latterly Mr. James Riley, with varying, and in many cases, satisfactory results. The ores of nickel in Canada contain from 3½ to 15 per cent. of the metal, which has a specific gravity of 8, whilst that of steel is only about 7·6. There are, however, many things to be considered before the metal can be profitably and easily applied, and when the great resources of our colony can be drawn upon to any extent.

LAUNCH OF H.M.S. "EDGAR."

On November 24th, at noon, the new protected first-class cruiser *Edgar*, believed to be the largest vessel ever built in Devonport Dockyard, was launched from that yard in the presence of a large number of spectators. The ceremony of launching and christening the vessel was successfully performed by Lady Edith Edgecumbe, and the huge vessel glided off the ways amidst enthusiastic cheering. Eight other cruisers of the same class as the *Edgar* are building in various public and private yards in the country. The *Edgar* is of 7,350 tons and 12,000 H.P., and has been built at a cost of £330,000, including her hull equipment, machinery, and armament. She is 360 ft. long, 60 ft. broad, and is expected to steam at a speed of 20 knots. She will be powerfully armed with 12 breech-loading and other guns of the newest type, and has an exceptionally strong protective deck extending her whole length. She will be protected from torpedo attacks by a complete net defence embodying all the latest improvements. She is coated with Hartmann-Rahtjen's composition. Her keel was laid down in June, 1889.

EAST LONDON ASSOCIATION OF MARINE ENGINEERS.

The eighth annual banquet of the East London Association of Foremen, Marine Engineers, and other branches of the trade, was held at the London Tavern, Fenchurch-street, on Saturday evening, November 22nd, Lord Brassey in the chair. Mr. T. Wishart Phillips was the vice-chairman, and amongst those present were Mr. W. H. White, F.R.S., Assistant-Controller of the Navy; Fleet Engineer T. W. Traill, R.N. Mr. F. E. Duckham, C.E., Mr. C. W. Manuel, R.N.R. (P. & O. Steam Navigation Company), Captain M'Kirdy (White Star Line), Mr. J. Boyd, the president, Mr. Ives, the vice-president, Mr. J. Macfarlane, treasurer, Mr. George Thornton, the hon. secretary of the association, and others. The loyal toasts having been duly honoured,

The Vice-Chairman gave "The Army, Navy, and Reserve Forces." Referring to the loss of her Majesty's ship *Serpent*, he said that among the possible explanations of the disaster was the presence of a magnetic loadstone iron on the coast of Spain, which had affected the compass and misled the captain. It had been said that there was bad feeling between the officers ("No") but they did not believe it.

Fleet Engineer Traill, in responding, paid a tribute to the conduct of the officers and crew of the *Serpent* in the time of disaster, as a specimen of the cool, calm, and self-forgetful devotion of duty which is everywhere to be found in the British service.

Lord Brassey, in giving the toast of the evening, "The East London Association of Foremen, Marine Engineers, and other Branches of the Trade," said there was no man more indebted than himself to the great mechanical trades of which the members of the association were the representatives. Everything that had come to him in life was owing to the introduction of the locomotive steam engine. It was by mechanical industry, combined with good technical and scientific knowledge, that the progress of the nation was to be maintained. Great respect was due to the foremen who had raised themselves to their position by the superior excellence of their own workmanship. They were useful, not only in the supervision of great businesses, but in maintaining harmonious relations between masters and men. They heard a great deal in these days about trade unionism. Among a certain section, and a powerful section, there was a disposition to call in question the right of the men to join themselves in labour organizations. He thought criticisms of that kind were somewhat out of date. Trade unionism had grown greatly, and in the prevailing mass of labour on the one side, and immense capital on the other, trade unionism had become inevitable. Very much depended on the foremen as to the manner in which harmonious relations were maintained. The Admiralty had shown the highest wisdom in committing a large portion of their shipbuilding and engineering for the Navy to those private firms in which the members of the association were engaged. He was quite sure the rivalry of private firms was a valuable safeguard for the industries of her Majesty's dockyards.

The Vice-Chairman proposed "Engineering, Shipbuilding, and Mercantile Marine." Mr. Manuel having replied for Engineering,

Mr. W. H. White, F.R.S., assistant-controller of the Navy, in responding for shipbuilding, dwelt on the relationship between shipbuilding and engineering, and expressed satisfaction at having been connected with practical industrial pursuits from the time he was 14 years of age. He held an indenture, of which he was very proud, showing that he had served his time as a shipwright. Referring to the loss of her Majesty's ship *Serpent*, Mr. White said that, whilst he would be responsible for his connexion with the building of the vessel, the designs were not his. Sad as the loss of the vessel was, it would be sadder if the cause was altogether unknown. The cause of the loss was now known, however, and there was nothing arising out of the loss which had the least relationship to the strength of the materials, quality, or workmanship, or character of the designs. They had had experience for years of vessels of a similar class to the *Serpent* in all parts of the world. Those vessels were still of the greatest service, and were handled with the greatest success.

Mr. F. E. Duckham, C.E., replied to the toast of "The Honorary Members."

Letters of regret at inability to attend were received from Sir William Arrol, Messrs. Penn, Humphrys, Maudslay, and other eminent engineers, as well as from Captain Sir John Colomb, M.P., and Mr. Sydney Buxton, M.P.

The report of the secretary, Mr. George Thornton, showed that the association has an increasing membership, improving finances, and steadily growing success of every kind.

Messrs. J. and G. Burn's steamer *Adder* has just been cemented at Glasgow with the light asphaltic cement, by Holzapfel's Compositions Co., Ltd.

Powerful Hopper Dredger for the Nicaragua Canal.—On November 14th there was launched at Renfrew complete, with steam up, a powerful screw propelling hopper dredger, built and engined by William Simons & Co., for the Nicaraguan Canal Construction Co., under the direction of Chief Engineer A. G. Menocal. This vessel has a capacity to carry 400 tons of dredgings, and will load itself with ordinary material in an hour. The bucket ladder, which works in a central well, is fitted with an endless chain of steel buckets, and adapted to dredge banks and shoals to a depth of 35 ft. under water level. The hull is constructed with the builders' patent raised forecastle, which permits the buckets to dredge in advance of the hull.

CAPTAIN BAKER'S HYDRAULIC DREDGER.

THIS hydraulic dredger, the details of which are the invention of Captain Baker, is a vessel named the *Cataract*, of 50 ft. in length by 14 ft. beam, with a draught of 22 in. when ready for action, and may be more properly described as a "Submarine Obstruction Disperser," as the excavated material is not brought to the surface, as is the case with "dredgers."

The power brought to bear on the material to be dispersed is a jet of water discharged at a very high rate of velocity. This jet is produced by one of Messrs. Merryweather's most powerful steam pumps, a description of which appears in this number, and when we say that the jet used carries a column of water into the air to a height of 180 ft., and that this emission equals 750 gallons per minute, our readers will have some idea of the effect produced on silt, sand, mud, and even much harder substances, by so powerful a stream, when properly directed.

The mechanism which governs the direction of this stream constitutes Captain Baker's patent, and consists of a set of telescopic tubes, three in number and each of about 10 ft. in length (the outer one being 4 in. diameter), and terminating in the usual branch pipe of an ordinary fire-engine hose, or, when clearing matter from a rocky bed, a semi-flexible one is substituted to prevent damage which might ensue to a more rigid pipe from any rise or fall owing to the "send" of the sea.

These tubes resemble a gigantic telescope, and, in the case of the *Cataract*, are, when extended, about 32 ft. in length. The telescopic arrangements of the tube enables it to be adjusted to suit the depth of water in which it has to work.

The machinery consists of a pair of horizontal pumping engines, supplied with steam from an ordinary return tube boiler, with cylinders of 14 in. diameter with an 8 in. stroke, and the pumps, which are double-acting and worked direct, are 7½ in. diameter, with also an 8 in. stroke.

These pumps deliver into an air vessel, from which a copper pipe, 4 in. in outside diameter and ⅛ in. thick, leads. This is attached to a leather hose which carries the flow up to the top of a small gantry. The dispersing tube is supported in this gantry, which is built over an open-bottomed well about 10 ft. from the bow of the vessel, by a gimbal arrangement, and, passing down through the well, directs the jet of water upon the obstruction to be removed. This gimbal bearing, in conjunction with the telescopic action, gives a universal movement. It is worked by two small hand wheels, one being for the fore and aft motion and the other for the port and starboard, and it is bolted to the top flange of the well. This well is splayed towards the bottom of the vessel, so that, in swinging the tubes, their direction is in no way interfered with, but the influence of the jet moving with a 15 ft. radius provides an area of 30 square feet, over which operations may be carried on without moving the vessel.

These operations are invariably begun on the edge of deep water and on the ebb-tide. When it is desired to alter the position of the vessel, this is accomplished by simply moving against the current by heaving round on the windlass until her next position is secured.

On Monday, the 27th ult., the *Cataract* was tried at Littlehampton, before a number of persons interested in hydraulic machinery and representatives of the Press.

The vessel works, as we have said, by cutting away the obstructing bed with a jet from the nozzle, this being kept an inch or two from the surface of the obstruction to be removed, the tide or stream being relied upon to convey the material displaced away, and to show how effectually this is realised, we may mention that in an experiment made, some few weeks before the trials under consideration, on the bar at the mouth of the little river Arun, which forms the port of Littlehampton, "the matter removed was easily defined for one mile from the point of disturbance," showing an immense dispersing power, as it had to rise through some 12 ft. of water before it could be defined on the surface.

Three trials were made on the date we mention—each of five minutes' duration. Before commencing, soundings were made, when a depth of water of 9 ft. through the well was found. On the inshore side of the vessel the depth was 8 ft. 2 in. and on the outside 9 ft. 9 in. The telescopic tube was then lowered to the required position and the pumping began, the pressure registered by the gauge of the air vessel to the pumps being about 70 lbs. At the end of exactly five minutes, soundings were again taken, when it was found that the depth through the well was 12 ft. 6 in., showing an increased depth of 3 ft. 6 in., while the inshore side showed 7 ft. 6 in. and the offshore 9 ft. 6 in. The tide was on the ebb and the flow was reckoned about three knots an hour.

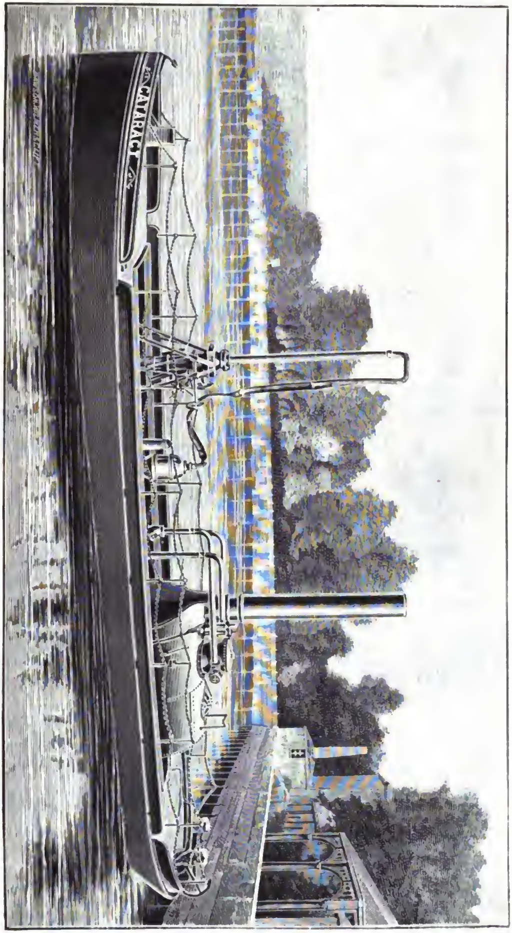
The second five minutes' trial was somewhat of a failure, the rigid nozzle having accidentally bent. A flexible nozzle having been fitted and the vessel's position shifted, the third trial was made with better results than the first, the depth excavated being 5 ft. 4 in., and the in and off shore sounding showing the area distributed must at least have been 14 ft. square.

The bottom of the Arun at the spot where the trials took place is a stiff blue clay of a very tenacious nature, and it speaks volumes for the powerful action of this dispersing jet to be able to cut a hole over 5 ft. in depth in five minutes through a substance which has withstood the "scour" of the river for nearly a hundred years—that is, supposing this blue clay was laid down as a puddle when the mouth of the river was diverted from its original course.

After these trials the jet was directed with great effect upon the mud and shingle on the harbour foreshore.

We believe that when the dredger was tried in Messrs. Merryweather's dock, prior to removal to Littlehampton, the action of the jet was so powerful that it penetrated so far into the chalk that several of the piles, which were sunk in to a considerable depth, were uprooted, causing some damage, which had at once to be repaired.

The experiments, which, so far as they went, were considered highly satisfactory, were carried out under the superintendence of the Harbour Master, and we congratulate Captain Baker on the success of his



S.S. "Cataract" fitted with Captain Baker's Hydraulic Dredger.

invention, which ought to prove of great value, considering the cheapness of both vessel and machinery.

We give a view of the *Cataract* as she lies in Messrs. Merryweather's dock, showing the telescopic tube and fixings. We may add that the invention is being brought out by the London and Colonial Finance Corporation, of 4, Coleman Street, London.

A NEW ASBESTOS-FACED VALVE.

THIS new asbestos-faced valve is introduced by Bell's Asbestos Co., London, and its speciality lies in supplying a flexible seating, which can be renewed when necessary in a few minutes at a trifling expense and requiring no special tools.

The engravings illustrate the arrangements. Fig 1 is an external view; Fig 2 shows the same in half section; and Fig 3 is a lettered and enlarged section of the valve and seat.

A represents the form of seat adopted, which, in addition to the ordinary angled seat, has a round edge to prevent damage to the packing ring B when the latter is brought into contact with it. D is a loose valve actuated in the ordinary manner by a screwed spindle working in gland of the valve top, which, when first set down, brings the packing ring B on to the seat A, and for ordinary pressures makes a perfectly tight and elastic joint, but by setting the loose valve D hard down, the sliding cone C comes into contact with the angle of seat A, and, being free on the guide stud E, is forced into the chamber of the loose valve D, and by compressing the packing ring B prevents it becoming damaged.

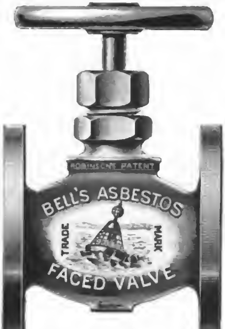


Fig. 1

While the packing ring B is thoroughly protected by the lower projection of the loose valve D, there is little [illegible] for B to become damaged by the passa[illegible] water through the valve, but should it even become entirely washed out, a tight metal to metal seating is the result by A, C, and D being brought closely together. Through its elastic seating this valve seems to be unaffected either by grit, dirt, expansion, contraction, or uneven seating, which makes it suitable alike for the highest or lowest pressures of steam or water.

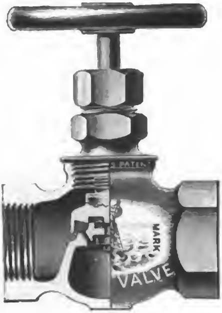


Fig. 2.

We recently saw a 1½ in. valve, made under this patent, which had been under test for three months at a steam pressure of 100 lbs. to the square inch, and found to hold perfectly tight. The same valve was also put under hydraulic test, and, when lightly screwed down, held a pressure of 2,240 lbs. per square inch. The ring used in this valve was made up specially in asbestos and seems to be still in perfect order, and we were assured that it had not been removed at any time during these trials or since.

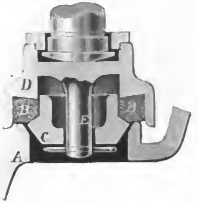


Fig 3.

Mr. John Anderson, 5, Park Gardens, Glasgow, has given an order to Messrs. Ramage & Ferguson, Leith, to build him a steel steam yacht of 450 tons to steam 12¾ knots. The vessel will be fitted with electric light, and is to be ready on the 1st July. The *Katrena*, built for Mr. Anderson by the same builders, was sold last year to the Russian Government through Mr. Byrne, of Liverpool, who will design the new one.

ROYAL NAVAL EXHIBITION, 1891.

THE arrangements for this Exhibition, which, as our readers are aware, is to be held in the grounds of the Royal Hospital, Chelsea, as well as the negotiations between the executive of the late Royal Military Exhibition, the Commissioners of Chelsea Hospital, and the Executive Committee of the Naval Exhibition are now nearing completion.

The Naval Committee propose to acquire the whole of the buildings and ground of the site recently occupied by the Military, and, in addition, to lease several adjoining acres in order to give scope for naval displays.

The opening ceremony will be performed by H.R.H. the Prince of Wales, and as at present anticipated this will take place about the 2nd of May next.

The exhibition will, as far as possible, be arranged in four sections. No. 1 will be devoted to Arts, and embrace oil paintings, water colour drawings, engravings and sketches, naval relics and trophies, manuscripts, &c. No. 2 will be Models, including those of ships and boats, and all boat-lowering apparatus, marine engines, naval dress of various periods, life-saving apparatus, steering appliances, engine-room telegraphs, signalling appliances (electric or otherwise) for extinguishing fire, electric light machinery, steam capstans and windlasses, distillers and evaporators, materials used in ship and engine construction, machine tools in shipyards and engine factories, and armour plating. No. 3 will be given up to Navigation, and will include hydrography, chronometers and charts, compasses; arctic section, side and mast-head lights; flags, lighthouses and beacons, marine meteorology, sounding machines, patent logs and machines to assist in navigation. No. 4 will be assigned to Ordnance, and will be open for (1) working models (full size) of a barbette in present use in the navy, and turret and broadside mountings; (2) torpedo mountings, boats, &c.; (3) specimens or models of every gun (including rapid firing and machine), torpedo, rifle, pistol, &c., with their ammunition and stores, method of construction, &c., in use, or which have been used in the naval service; (4) quaint specimens or models of the system of submarine mining, counter mining, &c., in use in the naval service; (5) illustrations of the various systems of diving; (6) illustrations of the application of electricity to naval purposes, viz., lighting, gun firing, torpedo discharging, &c.; (7) illustration of the use of a captive balloon for naval purposes; and (8) illustration (by models or otherwise) of defence against torpedo and gun attack.

The collection of models will be large and beautiful, while the exhibition of pictures connected with naval and maritime matters promises to be exceptionally good. These have already been promised from all the leading families, and Trinity House is expected to make a particularly good show.

We may mention that all pictures sent on loan for exhibition will be taken the utmost care of by the Executive Committee, who, in addition, will defray all expenses in connection with insurance, transit, packing, &c., and as some misconception in a few cases seems to exist as to a charge being made for space, we have distinctly to state that no such charge is dreamt of; the only cases where a charge is made for space being confined to exhibits from which a *profit* may be expected, and this, of course, clearly does not apply to exhibits on *loan*. Applications for space, in the ordinary acceptation of the term, are coming in very freely, and altogether the exhibition promises to be, what we heartily wish, a great success.

Although the receipts from the exhibition will, it is anticipated, far exceed the outlay, yet it was considered desirable to have a substantial guarantee fund, and so release all connected from pecuniary liability, and we are glad to learn that this fund already exceeds the sum of £40,000.

The exhibition will be under the patronage of Her Majesty the Queen and the presidency of H.R.H. the Prince of Wales, the vice-presidents, ten in number, including Admiral H.R.H. the Duke of Edinburgh, K.G., Admiral Lord John Hay, G.C.B., Admiral Sir Geoffrey Hornby, G.C.B., the Earl of Northbrook, the Marquis of Ripon, &c.

The Council is large and very influential, and includes such names as these:—Admiral H.R.H. Prince Victor Hohenlohe, G.C.B., Admiral the Right Hon. Lord Alvester, G.C.B., Admiral the Right Hon. Earl of Clanwilliam, K.C.B., Rear-Admiral J. Fisher, C.B. (Director of Naval Ordnance), Rear-Admiral of the United Kingdom Sir W. F. Martin, Bart., G.C.B., Rear-Admiral E. H. Seymour, C.B., the Right Hon. the Marquis of Hartington, Sir Donald Currie, M.P., K.C.M.G., &c., &c.

THE NORTH-EAST COAST ENGINEERS AND SHIPBUILDERS.

A NUMBER of members of the Graduates' Section of the North-East Coast Institution of Engineers and Shipbuilders visited the Newburn Steel Works on November 19th by the kind permission of Messrs. John Spencer & Sons. The visitors were courteously received by the heads of the firm, and conducted over the works. In the evening the second general meeting of the Graduates' Section was held in the Institution's rooms, St. Nicholas Buildings West, Newcastle-on-Tyne, when there was a large attendance. Mr. Frank T. Marshall, president of the section, occupied the chair.

The President, in addressing the section, briefly reviewed the work of the past session, and urged all who were at present members to try and induce their engineering friends to join the institution. He referred to the visits paid to the works in the district, and said these visits broadened their professional horizon, and gave them a most valuable stock of general technical information which was every day proving useful, often when one least expected it, and often quite unconscious to themselves. He then referred to the subject which was at present attracting a great amount of attention, namely, recent troubles in the use of forced draught in marine boilers. He traced the origin of the system, and explained the system now in use. There had been a large amount of trouble with the boilers in war vessels recently when working under more or less severe forced draught. After steaming some time leakage had taken place, and this in many cases to such an extent as to cause the trial to be abandoned. This leakage had been for the most part located on the combustion chamber tube plate. All these boilers which had recently given out had been either of the type known as the double-ended return tube boiler or the modified locomotive type. He explained, by means of sketches on the blackboard and by giving the results of experiments, how the trouble had arisen with these two types. Engineers had got to construct a boiler of such a design as would be able to perform the work of evaporation under forced draught. The design of modified locomotive boiler had just missed making very successful boilers, and with slight modifications, had every prospect of being an unqualified success. It would appear that, given a sufficient water supply to the tube-plate, the modified locomotive boiler was qualified under every circumstance to work satisfactorily. As to the double-ended return boiler, the whole design was badly adapted to severe working. The solution of the difficulty seemed to be the subdivision of the combustion chamber, making each furnace have its own chamber, with ample capacity, and with its own set of tubes. This design was now being carried out in all the more recent double-ended boilers for the Admiralty. A frequent design was that of a boiler with two furnaces at opposite ends. These boilers had been worked very severely in many ships under forced draught with great success. Probably the most successful boilers of all under forced draught had been what were known as the Admiralty straight-through type. He was therefore of opinion that forced draught should not be condemned because certain boilers were incapable of taking advantage of it.

A discussion took place on the points raised in Mr. Marshall's address, and a vote of thanks was passed to him.

Messrs. J. D. F. Andrews & Co. have purchased the goodwill and assets of the firm of Messrs. White, Romanze & Co., of Kingsbury Road, Dalston, and 3 & 4, Great Winchester Street, E.C., who have been carrying on a considerable business in the manufacture of arc lamps, switches, &c., and also telephones, type printing instruments and electric bells. Besides many important electric light contracts, Messrs. Andrews & Co. intend continuing all the manufactures hitherto carried on by the late firm, but they are about to remove the machinery from Dalston at an early date to more commodious premises. Mr. F. White, of the above firm, who is well known in connection with electric light and telephone work, has assumed the position of manager with Messrs. Andrews & Co.

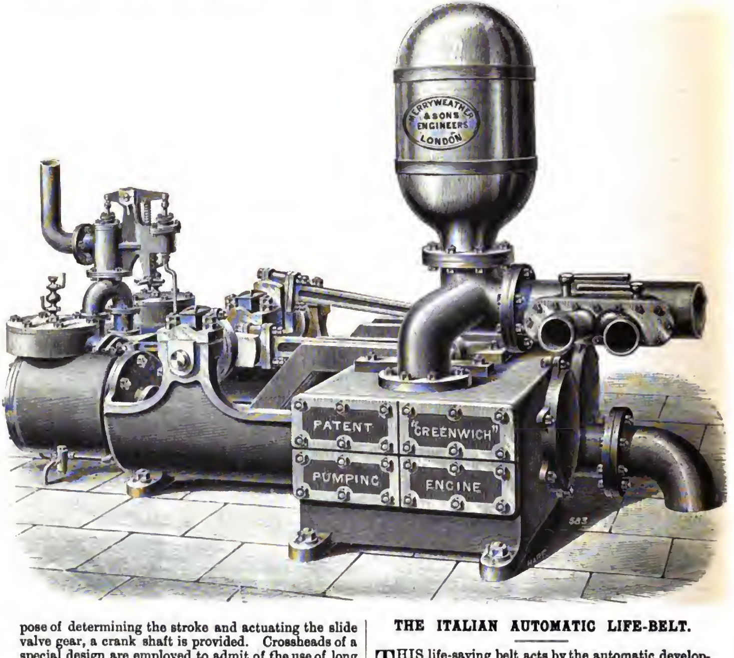
MESSRS. MERRYWEATHER & SON'S PATENT "GREENWICH" PUMPING ENGINE.

OUR illustration shows one of these engines, which in another part of this number we refer to as being fitted on board the *Cataract* for working Captain Baker's hydraulic dredger.

The engine is direct-acting, the pump pistons being on the same rods as the steam pistons. For the purpose of determining the stroke and actuating the slide valve gear, a crank shaft is provided. Crossheads of a special design are employed to admit of the use of long connecting rods, whereby a very even motion is obtained.

The slide valves are of cast-iron, and also of special design, and all details are very simple and free from complication. The pump is of cast-iron, with gun-metal liners and valve seats, and is arranged to allow of quick and easy access for examination. The valves are of rubber of special form, a capacious air vessel is provided, and the whole of the workmanship is thoroughly substantial and reliable, in fact this pump possesses all the features of the well known high-class Merryweather fire engine, and is supplied at a moderate cost.

It is made in four sizes, to deliver 450, 750, 1,100, and 1,400 gallons per minute respectively; the cost depending on the size of steam cylinders, which in each case is arranged to suit the pressure of steam available.



THE ITALIAN AUTOMATIC LIFE-BELT.

THIS life-saving belt acts by the automatic development of gas under strong pressure in the sections of which it is composed the moment it touches water, thereby becoming capable of keeping afloat for a long time the most heavily-clothed person.

The invention emanates from Italy, and is called the Frattini-Ingaramo patent, and after being adopted by the principal steamship navigation companies of that country is now being introduced into this by Sig. Arturo De Rossi-Gallico, who, on the 14th November last, read a most interesting descriptive paper on its merits and adaptations before the members of the Balloon Society of Great Britain in their lecture hall, at St. James' Hall, Piccadilly, London, Mr. Le Fevre presiding.

The belt is very compact, light, portable, and, in a non-inflated state, flat, and can be worn constantly without the least inconvenience, and even slept in. Its chief feature lies in the means by which inflation is effected. This is accomplished by carbonic acid gas instantaneously produced by the combination of the acids and alkalis with which the compartments of the belt are charged on its being brought into contact with water. The one intended for passenger use inflates, as we have said, on touching water, that intended for the use of officers and seamen is made different. It is easily understood that a belt which would inflate simply by being brought into contact with water, would be rather inconvenient wear for those whose duties expose them more or less to a wetting, so to avoid this a special arrangement is made. The acid and alkali are introduced into the belt in a liquid form, and when the moment arrives for the services of the belt being required, all the wearer has to do is to pull two small tassels which at once allows the chemicals to mix and the belt is at once inflated. This was demonstrated at the lecture by Sig. Rossi-Gallico, who inflated both classes of belts, the one by wetting, and the other by pulling the strings, in something like fifteen seconds. The belt was also shown enclosed in a brass bomb furnished with cord to allow of its being swung to a distance from the ship, and is so constructed that on its touching the water it sinks for a second, and then a fully-inflated belt appears on the surface with sufficient floating power to support two men for forty hours. The belt can also be discharged by rocket to a drowning person quite 1,000 yards away, and may carry a line with it to draw to shore or deck the person to be rescued. The belts are made in strong material for rough usage, and in the lightest and most elegant cotton and silk for ladies, to whose bathing dress it adds a decided ornament. Sig. Rossi-Gallico may be communicated with at 27, Chancery Lane, London.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from October 27th to November 24th, 1890 :—

Allden, Frank A., engineer to the *Dreadnought*, to date November 24th.

Armstrong, James, engineer to the *Hecate*, to date November 24th.

Austin, Fredk. W., engineer to the *Rattler*, to date November 24th.

Attwood, Geo., assistant engineer to the *Agamemnon*, to date November 24th.

Ayres, Robert B., engineer to the *Agamemnon*, when recommissioned, to date November 24th.

Baron, Rodger (probationary), assistant engineer to the *Himalaya*, to date November 18th.

Barry, James H. D., assistant engineer to the *Mowark*, to date November 18th.

Bath, Geo. C., engineer to the *Agamemnon*, when recommissioned, to date November 24th.

Bissaker, Alfred C., engineer to the *Thunderer*, to date November 17th.

Blakeman, Mark, engineer to the *Vernon*, to date November 17th.

Bromley, Wm. (b), chief engineer to the *Goldfinch*, to date October 4th.

Brown, Walter, engineer to the *Salamander*, to date November 18th.

Chater, Jas. D., staff engineer to the *Pembroke*, additional, to date November 21st.

Craddock, Geo. T., fleet engineer to the *Agamemnon*, when recommissioned, to date November 24th.

Crisp, Arthnr S., assistant engineer to the *Invincible*, to date November 24th.

Dalrymple, John H., engineer to the *Mowark*, to date December 16th.

Dart, Fredk. H., engineer to the *Dreadnought*, when recommissioned, to date November 24th.

Downer, John M., engineer to the *Dolphin*, to date November 17th.

Edwards, Walter, assistant engineer to the *Dreadnought*, to date November 24th.

Ellis, Matthew W., chief engineer to the *Pique*, to date November 1st.

Griffin, Daniel, chief engineer to the *Spartan*, to date November 8th.

Hutchings, Fredk. H. (probationary), assistant engineer to the *Agamemnon*, when recommissioned, to date November 24th.

Jacob, Chas. R., assistant engineer to the *Dreadnought*, when recommissioned, to date November 24th.

Matthews, Wm. H., chief engineer to the *Devastation*, to date November 1st.

M'Avory, Wm. R., flee engineer to the *Minataur*, to date November 24th.

Midgley, John W., engineer to the *Northumberland*, to date November 24th.

Mitchell, Fredk., chief engineer to the *Polyphemus*, to date November 17th.

Moffatt, Edwd. G. P., engineer to the *Swift*, when recommissioned, undated.

Moon, Robert C., staff engineer to the *Pembroke*, additional, to date October 31st.

Peak, Wm. M., fleet engineer to the *Orion*, to date October 31st.

Perkins, Geo. L. R., engineer to the *Melita*, to date November 24th.

Ramsay, Thos. W. H., fleet engineer to the *Dreadnought*, when recommissioned, undated.

Reynolds, J. A. (for temporary service), engineer to the *Goshawk*, to date November 1st.

Reynolds, Thos. R., engineer to the *Neptune*, to date November 24th.

Rundle, Richd. T., staff engineer to the *Active*, to date November 24th.

Russel, Charles S., assistant engineer to the *Ruby*, to date November 24th.

Simmons, Geo. T., chief engineer to the *Amphion*, undated.

Smith, Wm. A. P. (probationary), assistant engineer to the *Immortalité*, to date November 24th.

Stainton, Geo. H. (probationary), assistant engineer to the *Orontes*, to date October 29th.

Stevenson, John L., staff engineer to the *Orontes*, to date November 1st.

Taylor, Chas. J., engineer to the *Gossamer*, to date October 30th.

Tregenna, Richd. H., staff engineer to the *Rover*, to date November 21st.

Whebby, Thos., chief engineer to the *Sheldrake*, reappointed on promotion, to date September 20th.

Wooton, Wm. W., chief engineer to the *Mowark*, to date November 18th.

Yeats, Henry T., engineer to the *Hibernia*, additional, to date November 1st.

MESSRS. JAMES & GEORGE THOMSON, Limited, Clydebank, have contracted with the new firm of Lloyd's Braziliero Steamship Co., of Rio de Janeiro, to construct two large steamships similar to those previously constructed by the firm for the Brazilian Steam Navigation Co., whose dimensions were—Length, 282 ft.; breadth, 38 ft.; depth, 22 ft.; and of 2,000 tons, and the engines of 2,500 I.H.P. The new vessels will be fitted up in the most elaborate style.

HOAR & BROWN'S LONDON HARDWOOD MARKET REPORT, Nov. 24th, 1890.

Teak.—The deliveries for the last four weeks have been—

Logs.	Planks.	Blocks.	Total.
1,120 Loads.	243 Loads.	31 Loads.	1,394 Loads.

These figures include a large quantity of inferior stock, thus easing the market considerably of the accumulation of low-priced rubbish, which has been such a disturbing feature of late. Some fresh importations are now on view, which, if considered as samples, promise well for future shipments. Enquiries are fairly numerous, but at present there is ample stock to fill them, and prices are expected to remain stationary for a considerable time.

Mahogany (Honduras and Tobasco).—Although there are several arrivals, the market remains firm, especially for better class logs, and it is expected prices will reach a higher figure, but for inferior and minimum stock there is little demand.

The deliveries have been very satisfactory, and the coming sales are anxiously awaited.

Cuba and St. Domingo. The arrivals have been excessive, causing a fall in values, especially for small sizes. Large wood, however, has maintained its price, although there are very few enquiries about for Cuba and St. Domingo of any description.

Cedar.—The position is unchanged by the late arrivals (one of which appears to be a bastard importation), and there is little prospect of any improvement in prices.

American Sawn Walnut and Whitewood.—A fair business has been done in the various descriptions, but the stock is still very much in excess of what it should be, and serious reports are circulated to the effect that the entire stocks of one or two shippers are likely to be placed upon the market, without reserve, a course which would no doubt result in a complete chaos among holders.

Walnut logs of good character are very scarce, and consequently realize very high figures. There is little demand for inferior classes, the prices asked being considered much too high for any speculation.

Oak.—Sales have been more numerous, but prices have not moved.

Greenheart.—In consequence of the bareness of stock, this wood still remains quiet. Shippers have sold so much for forward delivery to the North that there is no chance of any cargoes being landed here for many months.

Kawrie Pine.—The market is exceedingly quiet, and there are likely to be forced sales shortly, which will go to test the market value and bring this timber more into notoriety.

Padouk is selling quietly at the old prices, and is still gaining favour among manufacturers.

Sequoia.—Stocks are being slowly reduced, although at a price hardly paying the shippers.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

Work in the Clyde shipyards proceeds at a briskly even pace, and builders are still able to hold out for rather stiff prices from owners. Quite a large number of enquiries have been received during November, and a gratifying amount of new shipping has been ordered.

Marine engineers are correspondingly busy; indeed, more so, as quite a number of old vessels are being re-engined. Owners of steamers are taking opportunity, as it presents itself, to have all the vessels of their fleets fitted with the triple or quadruple-expansion type of engines, in place of the old compound type, which is almost universally regarded as inefficient and wasteful. The cognate industry of boiler making is of course correspondingly active.

Greenock has fared well in the dispensation of fresh contracts given out since last month's notes; Messrs. Scott & Co. secured about the end of October the contract to build and engine three steel screw steamers of about 2,000 tons each for Messrs. John Swire & Sons, London. The steamers are intended for Eastern trade, and will be supplied by the builders with powerful engines of the most approved type.

Messrs. Scott & Co. have also contracted with the Lords of the Admiralty for the construction of two sets of twin-screw triple-expansion engines of 13,000 power each, for H.M.S. *Barfleur* and *Centurion*, now under way at Chatham and Portsmouth. The same firm are also despatching new engines of 8,500 horse-power for H M.S. *Hercules*, undergoing refitting at Portsmouth.

Messrs. Scott & Co. have laid the keel for a new sailing vessel—four-master—in the shipyard purchased some years ago from the trustees of the late Messrs. Steele & Co., and which has been unused since 1883.

Messrs. Caird & Co., whose hands are almost constantly employed on work for the Peninsular and Oriental Co., have arranged contracts with that large company for the construction and engining of two monster steel screw steamers, each of about 7,000 tons.

Mr. Thomas Orr, jun., has received an order from Mr. John Anderson, Glasgow, to build a steam launch 50 ft. in length.

Messrs. Robert Duncan & Co., of Port Glasgow, have contracted to build a large four-masted steel sailing ship for the Village Line, owned by Councillor Guthrie, Glasgow.

Messrs. Blackwood & Gordon, Port Glasgow, continue to be busy in both their shipbuilding and engineering departments. Their latest contract is for the construction and engining of a speedy paddle steamer for the City of Dublin Steam Packet Company, suitable for the company's passenger, goods and cargo trade between Dublin and Liverpool. The vessel, which will be of steel, will be 262 ft. 10 in. long, 27 ft. beam, and 14 ft. 6 in. deep. She will be fitted with a pair of powerful compound engines, supplied with steam from two long boilers at a working pressure of 150 lbs. per square inch, and designed to drive the vessel at a speed of about 15 knots per hour.

Messrs Russell & Co., Port Glasgow, are, as usual, proverbially active in turning out sailing ships and booking new contracts. Their total output for the whole year will again top the list and will be something like 60,000 tons. Their latest order is for a steel sailing ship of 2,820 tons carrying capacity, for Messrs. H. A. Meyer & Co., Blankensese.

Messrs. Charles Connell & Co., of Whiteinch, near Glasgow, are building two steel sailing ships of 2,800 tons for Messrs. Blohm & Voss, of Hamburg. The working community of Whiteinch are at present jubilant over the good news that the shipbuilding yard of Messrs. Thomas Wingate & Co., of Whiteinch, which has been closed since 1879, has been leased by Messrs. Alley & Maclellan, engineers, Polmadie. This firm, however, do not intend to open it as a shipyard, and have no intention of removing their works from Polmadie, the district being most suitable for the class of work they lay themselves out for. The Whiteinch establishment will be used for an enlarged branch of their present engineering business, and it will afford employment to a large number of hands.

At Dumbarton Messrs. Denny & Bros. are making good progress with the large Union liner *Scott*. She will in all probability be launched about the end of December, and her tonnage will materially help to swell the output of the firm for the year, she being the largest vessel ever constructed at Dumbarton. The firm are just completing the large British India steamer *Jelunga*.

In addition to the orders for new steam yachts noticed in last month's notes as having been given out by Mr. G. L. Watson, the renowned designer of Glasgow, further orders for two similar craft to his design have been given out during November. One is for a steam yacht of 1,000 tons, being the largest steam yacht ever built in this country for a private owner. The owner in this case is M. Kousnezoff, a Russian millionaire. The builders will be Messrs. Scott & Co., of Greenock, but she will be superintended during construction by Mr. Watson. Some of the dimensions of the yacht will be:—Length, between perpendiculars, 240 ft.; moulded breadth, 30 ft. 6 in.; depth, 20 ft. 6 in. This vessel will be completed in June, 1891. Messrs. Scott & Co. will make the machinery, which will drive this splendid craft about 15 knots. The fitting and appointments will be on a complete scale, and nothing will be spared to render the yacht in every way worthy of the reputation of the builders and designer. The fourth steam yacht Mr. Watson has on hand is for the Egyptian Government, and is to be built by the Ailsa Shipbuilding Company. This vessel will be engined by Messrs. Muir & Houston to drive her at 12 knots. The dimensions of this vessel are—Length, 145 ft.; moulded breadth, 22 ft.; depth, 13 ft.

Messrs. Hugh Smith & Sons, of Possil Engine Works, Glasgow, the well-known makers of heavy machine-tools for shipbuilders and engineers, have recently got through a spell of exceptional pressure on the capacity of their large establishment for producing their specialities, and they still continue well employed. A recent visit to their works showed their employés busy upon one of the enormous hydraulic plate-bending machines, 22 ft. in length, and weighing about 65 tons all told; also a powerful set of their vertical plate rolls, 10 ft. deep, and capable of rolling boiler plates, cold, up to 1¼ in. thick, besides numerous other items of the firm's manufacture. The rolls referred to are intended for Messrs. John Readhead & Son, of South Shields. The plate-bender is a tool which has within the past two years been largely taken up by the foremost shipbuilding firms throughout the kingdom, including Thos. Gray & Sons, of Hartlepool; the Barrow Shipbuilding Co., the Fairfield Co., Govan; Messrs. J. & G. Thomson, Clydebank; Messrs. Harland & Wolff, Belfast, &c. The bender now at work in Fairfield is 32 ft. in length, weighs 115 tons, and has operated upon plates 1¼ in. thick. It is only one of numerous of Messrs. Smith's specialities to be seen at work in that large establishment, a second noteworthy machine-tool being a very long and powerful ship-plate roller. The firm have recently fitted a complete installation of hydraulic riveting plant in the Barrow establishment, designed to take the place of the pneumatic riveting plant previously in use.

The first of a course of lectures on Naval Architecture, by Professor Jenkins, of the Chair of Naval Architecture in Glasgow University, was delivered on the 12th ult. before a goodly audience, and one has been delivered on each succeeding Wednesday evening since. The special subject treated of is "The Stability of Ships," and the ground covered is, as far as possible, that gone over before students in the day classes.

Professor J. G. Ewing, who has for seven years occupied the Chair of Engineering and Drawing in University College, Dundee, has been appointed to the Professorship of Mechanism and Applied Mechanics in Cambridge University, in succession to Professor Stuart, M.P., resigned. Professor Ewing, who is a native of Dundee, is 35 years of age, and a graduate of Edinburgh University. Previous to his appointment at Dundee he acted for five years as Professor of Mechanical Engineering in the University of Tokio, Japan. He has contributed several articles on engineering subjects to the recently-completed edition of the "Encyclopædia Britannica."

TRADE NOTES FROM THE TYNE, WEAR TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—A decided falling off of inquiries for new tonnage has been the feature of the month, and little, if any, business has been done in the way of placing new contracts. The unremunerative state of the freight market, and the harassing policy pursued by the various trades unions connected with shipping have evidently exercised a restraining effect on the shipowners, and the disposition to embark in further speculative enterprises is now less visible. Were it not for the fact that wooden sailing vessels and steamers of the ancient type that are provided with no better means of propulsion than compound engines are rapidly becoming obsolete, a period of very severe depression in shipbuilding might now be looked forward to; but in spite of low freights and the obstructive tactics of the unions, the last-named circumstance will doubtless keep the trade going steadily for some months to come, as the stress of competition will compel the substitution of new vessels for those at present in use in many cases. For the moment, however, no new business is being negotiated, and it is fortunate indeed that during the autumn months the leading firms in the district had secured sufficient orders to keep the yards in a fair state of activity over the winter. One serious cause of anxiety to shipbuilders has been removed by the settlement of the joiners' strike, and it is to be hoped that no such unwarranted interference with the progress of industrial operations will ever again be attempted. If anything may be learnt by observation, the study of this dispute should tend to the development of pacific sentiments among workmen; as the joiners who turned out on strike without justification, and for some fifteen weeks kept the trade of the district [so far as shipbuilding was concerned] in a state of considerable jeopardy, had ultimately to return to work with practically no advantage gained. What they lost, and what the district lost through their folly, it would be impossible to estimate even approximately; as, in addition to the large amount of work that was sent away to be done elsewhere, several contracts of the first importance that might have been obtained by local builders were allowed to pass into other hands. Amongst the work sent away was the fitting of the cabins, &c., on a fine passenger steamer built by Messrs. Armstrong, Mitchell & Co. to the order of Hamburg owners, and which sailed from the Tyne about the middle of the month for Hamburg, where the joiner work will be completed. The eminent shipbuilding firm just mentioned have now several oil-carrying ships to lay down at their Low Walker yard, and it is understood that they will build at least one such vessel at their Elswick establishment, where the last of the war vessels on order is now approaching completion. Messrs. Wood & Skinner have four vessels on the stocks at their Bill Quay yard, besides one fitting out in the river. This firm have, during the past year or two, been conspicuously successful in securing foreign orders, and it is understood that most of the vessels now in progress, have been ordered by Swedish or Norwegian owners. Messrs. W. Richardson & Co. have most of their berths occupied, the vessels on the stocks being all of large tonnage, and at Messrs. C. S. Swan & Hunter's yard there are five vessels of large dimensions on the stocks, besides two or three getting their fittings completed in the water. At Messrs. Schlesinger & Davis's yard there are a good many empty berths to be seen, but on the opposite side of the river, at Messrs. Hawthorn, Leslie & Co.'s establishment, a very different scene is presented, every berth having an occupant, and an appearance of general briskness being observable. This firm have built some magnificent passenger steamers for Russia, one of which is just now receiving the finishing touches beside the wharf, and will shortly be delivered to the owners. The firm are now laying down a vessel which is to be nearly 500 ft. in length, and which is also understood to be ordered by Russian owners, and they have also in progress several small steamers of a special class. They have besides some repair contracts on hand, and with reference to their extensive graving dock, it may be stated that during the present year, it has scarcely been a day untenanted. Messrs. R. Stephenson & Co. launched early in the month, a large steamer built to the order of Messrs. T. Wilson & Sons, Hull, and the second-class cruiser which they are building for the Admiralty will shortly be ready for putting off the stocks. The Palmer's Shipbuilding and Iron Co. will also be able to launch the first of the three cruisers they have in hand very shortly, and the construction of the first of two line-of-battle ships is well advanced. The firm have also in hand several large steamers, intended for the Mediterranean trade, and ordered by a newly-formed company of English and Italian shipowners. The Edwards Shipbuilding Co. have most of their berths empty, but at Messrs. Readhead & Co.'s yard the whole of the building space is occupied, and in all the departments exceptional briskness exists. The Blyth Shipbuilding Co. have, since the opening of their large graving dock, considerably increased the scope of their operations, more particularly in the departments of hull and engine repairing. They have just now alongside the yard a large steamer, getting new decks fitted, and a second vessel is undergoing very extensive structural alterations, with a view to the carrying of water ballast. There is also a vessel in the graving dock undergoing survey and alterations, and another vessel is having a new donkey boiler fitted, and some deck repairs being carried out. In new work they have a handsome passenger steamer for China being fitted out, and a second vessel, which is also intended for the Eastern trade, has just been launched. There is on the stocks a steamer of somewhat small dimensions, which is well advanced in plating, and another of 4,000 tons carrying capacity is in course of being framed. In addition to the foregoing the company are turning frames for other vessels, and will doubtless be able to keep their machinery fully going for many months to come.

Engineering.—Great activity continues to characterise the leading marine engineering establishments, and night shifts are generally maintained. Boiler works are also very busy, among the most active being the boiler department of Messrs. John Abbott & Co., Gateshead, where there are some exceptionally large stationary boilers now in course of construction. Messrs. Clark, Chapman & Co. have also a large amount of work in their boiler department, and are more than usually busy in the steam winch and windlass shops. The Ouseburn Forge is extremely busy, the work in hand consisting principally of ship and engine forgings; and at most of the other forges the state of business is satisfactory. In the iron foundries work is plentiful, and brass foundries are generally well employed. Messrs. Proctor & Son, of 29, Side, Newcastle, are receiving large numbers of orders for their corrugated copper buoyancy cases for ships' boats, and their works are consequently exceptionally busy. A new evaporator for supplying fresh water to marine boilers is being introduced by Messrs. Noble & Buckle, consulting engineers. It is called the "Yaryan," and is, we understand, of American origin. It has been tried on a steamer named the *Prudence*, belonging to Cardiff, and during two outward and two return voyages between this country and America its working has given satisfactory results. Many important advantages are claimed for this evaporator, as compared with similar contrivances now in use, and if after more extended trial it is found to possess those advantages, its future success would appear to be assured.

THE WEAR.

Shipbuilding.—The joiners and shipwrights of Sunderland have settled their difference in a more amicable manner than the same classes on the Tyne, the points in dispute having been arranged in friendly conferences between accredited representatives of the men concerned. There were, it is true, some matters in connection with the apportionment of work, which were by mutual agreement left to the employers to finally adjust, but this has now been done, and so far as the Wear is concerned, all causes of friction between these sections may now be regarded as at an end. The greatest impediment to the steady progress of work in this district is the difficulty of procuring adequate supplies of material from the steel manufacturers, and at many establishments this hindrance to business has for some time been causing serious inconvenience. While orders were in the market, the Sunderland shipbuilders succeeded in booking a good many, and though enquiries have now fallen off, the yards are generally well supplied with work. Messrs. J. L. Thompson & Sons have six vessels on the stocks, some of them being of very large tonnage. The firm are now fitting out a large tea ship, and they have also in progress a couple of vessels intended for the fruit trade. They have also an important repair contract, and in every department of their works an appearance of great briskness is presented. Messrs. Bartram & Haswell are preparing to launch a large vessel, and they are commencing the construction of one which, it is understood, will be the largest yet built by them. To provide room for this vessel, a rearrangement of the berths is found necessary, and is now being carried out. The Sunderland Shipbuilding Co. have recently obtained an order for a passenger vessel, and this, with the work already in progress, will keep the yard pretty busy for some months to come. Messrs. Austin and Messrs. Blumer have each a couple of vessels on the stocks; but at the Strand Shipbuilding Co.'s yard there is only one vessel in hand, and the building of this is well advanced. Messrs. R. Thompson & Son are, after a rather long period of comparative slackness, again becoming pretty busy, though as yet nothing like the full proportion of hands is employed. At the Bridge Dock they have had a good run of repair work this month, their success in this respect being largely due to the excellence of their facilities for executing contracts in that line. Mr. James Laing has orders for some very large vessels, among them being, it is stated, one for a passenger ship for the British India Steam Shipping Co.'s line. Messrs. Short Bros. have four large vessels on the stocks, and others are in preparatory stages. At Messrs. Priestman & Co.'s yard the berths are fully occupied, and both Messrs. Graham & Osborne and Messrs. Pickersgill have a fair amount of work in hand.

Engineering.—Following the lead of the boiler-makers, who, as stated in last month's notes, have instituted a crusade against overtime, the operative engineers of the district have held two meetings, at which measures were concerted for bringing about the abolition of "systematic overtime," and the limitation of the practice within certain defined lines. It is said that the meetings were representative of the whole North-East Coast, and that a determined attempt is to be made to carry out the project indicated. It may be that before ma[illegible] are past the necessity for such an action on their p[illegible]ist, as the work to be done may be insufficient to keep the factories going during even the ordinary hours; and little as they may think it, the restrictive tactics to which they are now resorting, may precipitate that state of things, so that the limitation of overtime may be brought about by different means to those they contemplate. The action of the trade unions in this and other matters is decidedly inimical to the development of trade prosperity, as the members of these organizations will ultimately find to their cost. It is unfortunate that they cannot be content with good wages, comparatively short hours of labour, and regular employment; but must needs devise projects to hamper and impede the enterprise, which provides for them all these essentials for comfortable living, and it is to be hoped that a more enlightened view of the situation will force itself upon them before they do themselves and the trade of the district irreparable harm. The leading marine engineering works are still very busy, and night work in many departments is found necessary. Most of the orders now in the hands of manufacturers are for engines of exceptionally large power, which are in almost every instance intended for vessels building in the port. At the Palmer's Hill Works orders for Dickinson's patent crank shaft continue to be freely received, and their manufacture adds materially to the general activity of the establishment. Steam winch manufactories continue to be kept in full work, though, as orders are now coming in but slowly, a prolonged continuance of the present briskness cannot be relied on. The Castletown Steel Works are very actively employed, and the weekly output is now very considerable. At the Monkwearmouth Ironworks business is more active than it has been for some time past, and the full resources of the establishment are being utilised. Some very extensive changes are contemplated at these works, with a view to further facilitate production. Forges and foundries are kept steadily going, and coppersmiths' shops are very busy. The strike at the Monkwearmouth pit having been settled some weeks ago, another local colliery strike is now announced, the miners at Silkworth having turned out because certain "deputies" employed in the pit are not members of the Durham Miners' Union. About 2,000 men and boys are affected.

The Hartlepools.—Messrs. W. Gray & Co., who have in their admirably appointed yards space for the simultaneous building of ten large vessels, are now having as much work as they can deal with, and are employing a very large force of men. The firm have put several vessels off the stocks this month, and will no doubt when this year's returns of tonnage launched come to be published, be found to have maintained the prominent position in the list which they have now held for some years. At Messrs. Withy & Co.'s establishment, the building berths are well filled, and Messrs. Irvine & Co. have also a good share of work in hand. Repair contracts are now pretty numerous, and all the above-named firms are more or less engaged on work of this class. The local engineering works continue to show evidences of fully maintained activity, and at the steel works the utmost briskness prevails. Orders are plentiful at the Hartlepool Rope Works, and Cement Works are doing a steady trade. Timber imports having somewhat fallen off, there is now less employment for labour at the docks, but at the sawmills and timber yards business is still active. The shipments of coals have for some months past been very satisfactory, especially when compared with the shipments for corresponding periods in former years.

Stockton.—The shipbuilding yards at this centre still present an appearance of general activity, and in the engineering works no signs of a falling off of business are as yet perceptible. Messrs. Blair & Co. have a large amount of work in hand, and since the middle of last month the following steamers engined at their works have had successful trial trips:—The s.s. *Oxfordness*, built by Messrs. Richardson, Duck & Co., of Stockton, to the order of Messrs. Farrer, Groves & Co., of London, having engines of 150 N.H.P., with cylinders 21 in., 34 in., and 56 in. by 36 in. stroke. The s.s. *Feronia*, built by Messrs. Ropner & Son, of Stockton, for Messrs. Gladstone & Cornforth, of West Hartlepool, having engines of 210 N.H.P., with cylinders 23 in., 38 in., 62½ in., by 42 in. stroke. Both these sets of engines are constructed to work at a steam pressure of 160 lbs., and on their trials were found to work very satisfactorily.

Middlesbro'.—Shipbuilders continue to be fairly b[illegible] busy, repair contracts constituting a large part of the wo[illegible] in hand. Messrs. Westgarth & English, marine engin[illegible] have still some good contracts uncompleted, and their [illegible] works are pretty certain to be kept busy for several mo[illegible] The Tees-side engine works are fairly well employed, and the whole of the steel works in the district are very busy. There is a good deal of work in the local foundries, and rolling mills are generally very fully employed.

Darlington.—A sliding scale for the regulation of operatives wages, which was arranged in connection with the Darlington Steel Works in 1888, but which terminated in July last, has been re-established, and the circumstance has resulted in a four per cent. advance being conceded to the workmen. Some doubt existed as to whether the men were entitled to this advance or otherwise, but an arbitrator to whom the matter was referred for decision has given his answer in the affirmative. Waggon works at this centre are well employed, and at the Darlington Forge Company's Works full activity is maintained.

Consett.—Very extensive additions to the premises of the Consett Iron Company are contemplated, among which may be mentioned a new mill for the manufacture of steel angle bars. The company are also making arrangements for the opening out of a large colliery, from which it may be presumed their coal supply will in the near future be mainly taken.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—A most remarkable and satisfactory improvement has taken place in the shipbuilding and engineering trades of this district during the past month. Mr. Bryce-Douglas, the Managing Director of the Naval Construction and Armaments Co., Limited, has returned from a business tour to Canada with his pocket full of the most important orders. He reports, and his report has since been confirmed by telegram from the *Times* correspondent at Ottawa, that he has secured the subsidy offered by the Dominion Government for a new and fast line of Atlantic steamers to trade between some English port to Halifax or Quebec, and there connect with the Canadian Pacific Railway, which communicates right across the continent with the port of Vancouver on the Pacific slope. Already the Naval Construction and Armaments Co. are engaged in building three fast steamers for the Canadian Pacific Railway Co., to trade between Vancouver, Japan and China. One of these, the *Empress of India*, has been launched, and will be ready for sea at the end of the year. She has a smart yacht-like appearance, and will be a fast steamer, having a very clean run, and 10,000 H.P. The second of these steamers, the *Empress of Japan*, will be launched on the 13th of December, and the third steamer, the *Empress of China*, is well forward in plating. The new Atlantic line, the construction of which has been entrusted with the Naval Construction and Armaments Co., will, to begin with, embrace a fleet of four large high-class passenger steamships, whose speed shall be not less than 20 knots an hour; but the scheme of which Mr. Bryce-Douglas is at the head also embraces a third line of steamers, to be placed on a new route from Vancouver to Australia, calling at the Sandwich and the Fiji Islands. The Dominion Government has already granted a subsidy for this new line, and the Australian Governments are now considering their quota of the subsidy, which will doubtless be forthcoming, inasmuch as this new route to Australia will reduce the time from this country by fully three days. It is evident from these facts that shipbuilding in Barrow will be a very brisk industry for some time to come. Mr. Bryce-Douglas has been busily engaged in booking new orders since he came home from America, having secured contracts for the building of 13,000 tons. These orders, four in number, embrace a new 3,000-ton steamer for Messrs. James Little & Co., of Glasgow, the engines for which are to be built by Messrs. Westray, Copeland & Co., engineers, of Barrow; a steamer of 2,800 tons for the British and African Steam Navigation Co., and two steamers of 3,600 tons for the West Indian and Pacific Steamship Co. In addition to these orders the Naval Construction and Armaments Co. have in hand three cruisers for Her Majesty's Government, two of which have already been launched, and the third, *The Naiad*, will be launched on the 29th November; a dredger for the European Commission of the Danube; two 2,800-ton steamers for Messrs. Elder, Dempster & Co., of Liverpool, and another 3,600-ton steamer for the West Indian Steam Navigation Co. In all these orders the Barrow Co. are supplying the engines, with the exception of Messrs. Little's steamer. It is noteworthy that the company have also several minor orders in hand in the engineering and boiler-making departments. It will naturally be seen that, with so full a budget of orders, the Barrow company are exceptionally busy, and are likely to be so for a considerable time to come. There has been a strike during the month of engineers against the plumbers on a technical question, as to whose work it is to make joints when plumbers' and engineers' work meet. This work has been done for some time by plumbers, and the engineers claim it as a part of their trade. The men have returned to work on the understanding that the difficulty must be settled by arbitration between the executives of the two trades. The trade in steel shipbuilding material is steadily maintained in this district, but orders from other districts have fallen off, although the demand on local account has gained strength. There is every probability at an early date that additional plant will be put down in this district to increase to a marked extent the production of Seimens-Martin steel for shipbuilding purposes. Prices are easier. Plates are quoted at £6 12s. 6d.; angles and other sections at £6, and steel boiler plates at £7 12s. 6d.

Whitehaven.—Nothing has yet been done with the Whitehaven Shipbuilding Yard. It is understood, however, that Messrs. Gilchrist & Co., engineers, of Liverpool, have made an offer for the yard, and it is now only a question of price.

THE MERSEY.

THE condition of the shipbuilding trade and the various allied branches of industry throughout this district remain in very much the same condition that has been reported for some time past. Apart from the large firm of Messrs. Laird Bros., of Birkenhead, who are not only kept busy with important contracts in hand, but have been booking a fair amount of new work recently, there have been practically no new orders given out, and the yards on the Liverpool side of the Mersey are slowly but surely getting to the end of the work they have in hand, with no present prospect of replacing contracts as they run out. The serious financial troubles which have become prominent with the close of the month have necessarily a still further extremely depressing effect upon trade, and are causing a general holding back from entering into new work of any importance, the operation of which is seriously felt in the shipbuilding industry. In the midst of all these disquieting conditions, and the utter inability of employers with the present cost of labour and production to entertain new work at anything like the prices at which it is only at present procurable, the workmen show no disposition to relax in the slightest degree the terms which they have forced upon employers. Their attitude continues quite as unreasonable as ever, and so far as the workmen are concerned, they seem determined not to give way in the least until some serious catastrophe in trade shall force them into a position in which they cannot help themselves. The outlook is certainly one of the gravest apprehension, as the employers feel so keenly that their workmen have taken an unjustifiable advantage of their position, utterly regardless of the effect it might produce upon capital, or the ruinous results that it may bring about to employers, that a day of severe retaliation may be looked for whenever the opportunity presents itself. On the part of some of the shipbuilding firms there is a disposition to allow their yards to lie idle as contracts are completed rather than seek for new work under the conditions which the workmen persist in imposing upon them, and to wait until the men are in some more reasonable state of mind, which shall induce them to meet the difficulties of employers with such concessions on the part of labour as shall enable them to grapple successfully with the altered conditions of trade. It must, however, be admitted that the position of the workmen is still sufficiently strong to enable them to maintain the attitude they have taken up for some time past. Although undoubtedly there is a serious decline so far as activity in the shipbuilding trade in this district is concerned, and a slackening off in the weight of new work coming forward in other branches of engineering, there is not yet that general falling away in the demand for labour which at all appreciably affects the out-of-employment returns of the principal trades union organisations. There has been some slight increase during the past month or so in the number of men in receipt of out-of-work support; but this has been due rather to disputes in several centres with regard to payment for overtime and other local matters than to any real slackening off in employment, and the returns of the Amalgamated Society of Engineers still show not more than 1¾ per cent. of its members in receipt of donation benefit, whilst the Steam Engine Makers' Society has not more than ¾ per cent. of its members in receipt of out-of-work support. Whilst the societies are in this exceptional condition with regard to employment, and there is a combined, steady increase of membership, as in the case of the Amalgamated Society of Engineers, which during the past month has added 750 members, bringing up the total membership to close upon 67,000, it can scarcely be expected that the men will voluntarily surrender any of the advantages they have gained during the recent period of activity in trade. It seems, therefore, likely that employers will have to wait patiently until a more general falling away in trade shall bring a sufficiently increased demand upon the funds of the trades union organisations as will compel them to acknowledge the altered conditions and recognise the necessity of assisting by lower rates of wages and other concessions, in restoring industrial development in the various branches with which they are intimately connected.

As already intimated Messrs. Laird Bros., of Birkenhead, are being kept exceedingly busy upon the important contracts they have in hand for warships, satisfactory progress being made with the *Royal Oak* for the British Government, and a few additional particulars with respect to the torpedo gun-boat the *Almirante Lynch*, of which we gave a full notice last month, will be interesting. In our report we gave the very satisfactory results of the official trials which had been made, and these have been more than endorsed by the conduct of the vessel during exceptionally severe weather in the passage to Cherbourg where she is receiving her ammunition. Messrs. Laird Bros. have received a letter from the chief engineer, written by order of the commander, which shows that under proper conditions a torpedo gun-boat is as well able to hold her own in heavy weather as any other vessel. He says that while under construction and on her trials he thought her an excellent vessel, but since leaving the Mersey and passing through the gales she has come through without sustaining any damage, he now considers her the finest vessel afloat; her movements were so easy throughout the worst of the weather that he could have used his guns effectually against an enemy if necessary. After leaving Milford Haven the weather got bad and increasing to fresh gales and high seas. In crossing the mouth of the Bristol Channel the seas were very heavy, and we all thought we were to have a hard time of it getting through, as there were some exceptionally heavy seas at times threatening to engulph the little ship; but really she was like a duck on the water—always keeping on the top of it, and all the water she took on board were slight sprays. The machinery has been working without the slightest hitch, and generally all has been doing well. Amongst new work the firm have in hand a fine passenger steamer for the Fleetwood and Belfast line which is being built for the joint service of the Lancashire and Yorkshire and London and North Western Railway Co. This vessel will be about 2,000 tons, and the engines will indicate about 4,000 H.P., and it will attain the exceptionally high speed of about 18 knots per hour. Another important piece of work, the result of which will be interesting, has been the re-engining of the *Violet*, one of the North Western paddle boats with triple-expansion engines. This may be regarded as something in the nature of an experiment so far as paddle boats are concerned, and the preliminary trials which have been made have, we understand, given the most satisfactory results. On the Liverpool side of the Mersey the position of the shipbuilding yards there remains practically the same as reported last month. Messrs. Royden & Sons are now finishing a large cargo steamer recently launched, of which we have already given particulars, and are completing another large vessel on the stocks, but this work is being finished without anything new coming forward. Messrs. Potter & Sons, who have, as already stated, put down a vessel themselves to build with a view of keeping their yard going and their workmen employed, have only this in hand, and report nothing new coming forward except at prices which it is quite impossible to entertain. Indeed the vessel which they have laid down is being built under the most unsatisfactory conditions so far as they themselves are concerned, the men showing no disposition whatever to meet the employers by any concessions either in wages or labour, and it is more than probable that as a mere matter of speculation the firm could have given the vessel out to build at a much less cost than under present conditions they can build it themselves.

Marine engineers report no new work giving out, and they are simply completing the contracts they have in hand. Boiler-makers are still tolerably well employed, but in this branch, so far as marine work is concerned, there is decidedly a falling away, but for inland boilers there are still plenty of new orders stirring.

In the iron trade the past month has been characterized by an uneasy tone throughout. The unsettled financial aspects have naturally disturbed the ordinary course of trade and tended to further weaken confidence in the future. The result has been that buying has been restricted to the merest hand-to-mouth requirements, and operations of any magnitude are for the present held in abeyance. This has naturally had a very depressing effect upon prices, and the tendency has been steadily downwards. For the present there is so little business being put forward that quotations are scarcely more than nominal, and represent only the approximate prices at which iron could be bought. For Lancashire pig iron makers would now accept about 49s. to 50s. less 2½ for forge and foundry qualities delivered equal to Manchester; whilst in district brands Lincolnshire could be bought readily at about 47s. for forge to 49s. 6d. for foundry; and Derbyshire is offering at from 46s. for forge, to about 52s. 6d and 53s. for foundry, less 2½ delivered equal to Manchester. Outside hands are very irregular in price, and although makers have not followed the very considerable depreciation in warrants they have had to give way very materially, and good foundry Middlesboro' could be bought at about 45s. 10d.; and Eglinton, which is held almost entirely in second hands, may be said to average about 59s. per ton net cash, delivered equal to Manchester.

For manufactured iron there has also been only the most limited enquiry possible, and makers in many cases have barely secured orders to keep them going on from hand to mouth, whilst very few of them have work ahead of any moment. Prices have been easing downwards, and with the close of the month there would be no difficulty in buying bars at £6 5s. to £6 7s. 6d., whilst hoops could be bought at £6 10s. to £6 12s. 6d.; common local made sheets at £7 10s., and the best qualities at £7 15s. to £8 per ton, delivered in the Manchester district.

The steel trade is showing the same quietude that has characterised other sections of the market. In hematites the buying going on has been of very small dimensions, but prices have been fairly steady, and good foundry qualities for local consumption have averaged something about 66s. to 67s., less 2½ delivered in the Manchester district, with billets obtainable at about £5 5s. per ton delivered. In manufactured steel there has been an almost complete absence of any buying going on to at all test prices, and the small orders that have come upon the market have been competed for by merchants at very low figures. Makers' quotations remain without any very material change, and for delivery equal to Manchester or Liverpool steel boiler plates may be quoted at about £8 5s. to £8 7s. 6d. per ton, with buyers, however, able to place out orders at under these figures. In shipbuilding material, steel plates are quoted by makers at £7 10s., round and square bars at £7 15s., and angles at about £6 17s. 6d. per ton, delivered ex steamer Liverpool. These prices, however, are scarcely more than nominal, as there is really no business doing at them to afford any basis for quotations, and there are sellers in the market at lower figures.

In the metal trade there has been a moderate amount of business doing, although this has fallen off, but manufacturers being generally full of work to keep men going for some time to come, hold firmly to late rates, and any giving way has been principally upon raw material. For delivery equal to Manchester or Liverpool prices are about as under: seamless brass tubes, 8¼d., ditto surface condenser plates (rectangular) 7d., brass wire 7½d., copper wire 9d., rolled brass 7¼d., steel brass 8¼d. to 8½d., yellow metal sheathing nails and spikes 8¾d., ingots all per lb., with copper ingots £65, and copper sheets £71 per ton.

In the timber trade the imports during the month have again been moderate, and the deliveries fair. Values, however, show no improvement, and stocks generally are too large for present requirements.

A steady business has been doing in the coal trade during the month, but there has been no pressure of demand such as is usually expected at this time of the year, and supplies of all descriptions are ample to meet requirements. The result is that prices are not being maintained at late rates, and for delivery at the High Level, Liverpool, or the Garston Docks good qualities of steam coal are readily obtainable at 10s 6d. to 10s. 9d. per ton, with sellers in some instances willing to take 3d. to 6d. under these figures for special parcels.

WELSH NOTES.

THE arrivals of tonnage at the port of Cardiff for the past week show an improvement over the beginning of the month. The imports are heavy, especially iron ore, and prospects are fairly good. On 'Change a sluggish feeling prevailed generally. Steam coal was in indifferent demand, and quotations all round ruled easier. In the house coal market an average business was done. For pitwood there was a good demand. In the freight market outward steam chartering was moderately active, but the number of fixtures reported was below the average.

In the manufactured iron and steel trades there has not been much doing, and the outlook is regarded as less encouraging.

The trade of the port of Swansea has been exceptionally active during the end of the month, and it is satisfactory to see that the improvement is general. For tin-plates prices are firmly maintained. The receipts from works have been in excess of the shipments. The financial crisis in London and New York has had a detrimental effect on metals.

Owing to the alleged failure of the Great Western Railway to carry out their agreement with the Rhondda and Swansea Bay Company, the latter have given notice of their intention to apply to Parliament for powers to complete their original scheme, by which Rhondda coal will be carried direct and shipped at Swansea independent of the former company.

On Saturday, November 15th, a number of steam lighters were successfully launched at Chepstow, at the yard of the late Mr. T. Walker. They are for employment at Buenos Ayres.

The South Wales Institute of Engineers are to have commodious premises in Cardiff, and the Marquis of Bute has promised a gift of £1,000, and the Monmouthshire and South Wales coal owners £2,000. This excellent engineering society dates from 1857.

A good deal of discussion has been going on at Merthyr, where the conference meetings of the colliers were held, and a more hopeful feeling seems to prevail about re-establishing the scale. It is evident, judging from the proceedings, that the colliers are hesitating whether they should make a demand for payment of small coal or not, and have agreed to let the question be settled by the Sliding Scale Committee. The declaration of another advance of wages made a fortnight ago must have improved the position of employers. Under the scale colliers now derive 52½ per cent. above the standard of 1887, and without a scale the common sense men amongst them know that they would not get anything like so much.

The Miners' Conference decided to advocate eight hours' work with all energy, and the various Liberal candidates are to be written to, and urged to maintain it in the House of Commons. Practically the eight hours appear to be in operation now in many collieries.

BELFAST TRADE NOTES.

TRADE still continues in a prosperous state here, though in the engineering branches there are more hands idle than for a considerable time past; however, with the work which is coming forward, in a short time the former activity will exist.

The Queen's Island Works (Messrs. Harland & Wolff) launched during the month the s.s. *Ernesto* to the order of Messrs. J. H. Fletcher & Co., Liverpool.

On November 6th, the fine screw steamer s.s. *Sobraon*, built to the order of Messrs. Brocklebank & Co., Liverpool, left this port, and she will shortly be followed by the s.s. *Memphis*, now nearly ready for sea.

Messrs. Harland & Wolff will have some launches shortly, and amongst other orders in hand are two twin-screw cargo boats for the White Star Line.

The additions to Messrs. Harland & Wolff's engine and boiler works are now being rapidly carried out.

Messrs. Harland & Wolff have, we understand, acquired the present patent slip, and are about removing same, and making such alterations in the shipyard as will admit of their constructing three additional building slips at that end of the Queen's Island Yard.

Messrs. Workman, Clark & Co., Limited, the Belfast Shipyard, still show the utmost activity, and during the month launched the fine screw steamer *Celtic King* to the order of Messrs. William Ross & Co., London.

They will launch shortly a screw collier to the order of Mr. Milligen, Belfast. The engines and boiler will be supplied by Messrs. Muir & Houston, engineers, Glasgow, and they have also an order for a steamer for local owners, the engines of which will be supplied by Messrs. Victor Coates & Co., Limited, Prince's Dock Works, Belfast.

They have in their finishing berths the s.s. *Celtic King* (which will be towed to Glasgow to receive her machinery at the hands of Messrs. J. & J. Thomson), and the s.s. *Helen Craig*. Their new engine and boiler works on the south side of the river are now in course of erection.

Messrs. McIlwaine & Maccoll, Limited, are pretty busy at present. The s.s. *Parkmore*, engined by them, and built by C. J. Biggar, Foyle Shipyard, Londonderry, to the order of Messrs. Johnston & Co., Liverpool, is now almost ready for sea. During the month they gave very extensive repairs to the s.s. *Parkmore*, owned by the Antrim Iron Ore Co., the s.s. *Balniel* and s.s. *Ormerod*.

They will launch a fine steamer shortly; among other orders they have the order for Mr. Lawther's vessels and a small twin-screw steamer, also a large screw steamer.

The s.s. *Susannah Kelly*, built and engined by them to the order of Mr. John Kelly, Belfast, was taken on her trial trip on November 1st.

Messrs. Victor Coates & Co., Limited, at their dock foundry have on hands the engines and boiler for the s.s. *Helen Craig*, and another set for a steamer building by Messrs. Workman, Clark & Co., for local owners. They have obtained the contract for the pumping engines for the Duncrue Street Station of the Belfast Main Drainage Works, for the Corporation of Belfast.

The fine set of triple-expansion engines (marine type), and the first of the kind about Belfast erected by them in the Hilden Mills, Lisburn, are running very satisfactorily; at present they are indicating over 800 H.P., and when fully loaded will indicate 1,200 H.P.; the boilers are of the Lancashire type.

One of the lighthouses in course of erection in the new channel, Belfast Lough, is now complete, and the others are in an advanced state.

The s.s. *Governor Alberquerque*, which was purchased by Stanley, and conveyed him and his party up the Congo River, arrived in Belfast, and the fact of her having been used by the great explorer caused her to be an object of interest during her stay here.

The Commissioners of Irish Lights invite tenders for the erection of addition to lighthouse tower, new keeper's dwelling, fog signal house, out-offices, with tank, &c., at St. John's Point Lighthouse, Killough, Co. Down.

It is understood the Government contemplate the establishment of a dockyard at Belfast, on the Co. Antrim side of the river, convenient to the shipbuilding yard of Messrs. Workman, Clark & Co. Belfast is admirably suited for works of the kind, and the new graving dock and the fine crane offers facilities for carrying out the heaviest class of work.

Mr. George Murdoch, son of Mr. George Murdoch, Clarendon and Prince's Dock Engineering Works, Belfast, has obtained an extra first-class certificate, and has we learn been appointed Lloyd's surveyor at Cardiff.

LEITH NOTES.

AS the close of the year approaches we begin to look into the prospects for the ensuing year, which are certainly not as promising as we would wish, still, with the work on hand and the addition of a few new orders, there will not be much to complain of in the first six months.

During the past month four new orders have been received in Leith. Messrs. Ramage & Ferguson have orders for a steam yacht, 166 ft. long, 24 ft. beam, and 14 ft. 6 in. depth, moulded; 450 tons Thames yacht measurement, for John

Anderson, Esq., Glasgow. A four-masted steel sailing ship of 3,000 tons net register for Messrs. Gillison & Chadwick, Liverpool. Messrs. Hawthorns & Co. have got the order for a small cargo steamer, 135 ft. long, to be supplied by them with compound engines, having cylinders 18 in. and 36 in. diameter by 24 in. stroke. Messrs. S. & H. Morton & Co. are to build a set of horizontal triple-expansion engines and pumps, the engines having cylinders 20 in., 26 in., and 46 in. diameter. There will be two pumps wrought from each engine, six pumps in all. These engines are for Newbattle Colliery. The Grangemouth Dockyard Co. evidently expect a busy new year, as they have bought a shipbuilding yard at Ardrossan, which has been unoccupied for some time. This makes the third yard under the management of the same company, the other two being at Grangemouth and Alloa respectively.

Early in the month large numbers of the Fife and Clackmannan miners gave in their notices to suspend work, in consequence of the masters' refusal to grant an advance of wages, but on the 10th these notices were wisely withdrawn.

On Monday, the 10th, at a statutory meeting of the Alloa Burgh Commissioners, the draft agreement between the Alloa Harbour Trustees and the North British Railway Co., whereby the latter purchase all the proprietary interests in the harbour, was submitted for the consideration and approval of the commissioners. This acquisition of the Alloa harbour by the North British Railway Co. seems very like a *quid pro quo* to the tactics of the Caledonian Railway in respect to their acquisition of the Kirkcaldy Railway and dock scheme mentioned below.

An agreement has been entered into between the Caledonian Railway Co. and the Kirkcaldy and District Railway and Dock Co., by which the railway company are to complete the dock and railway works that have been in progress for some time. It is said that a Bill is to be promoted for this purpose in the ensuing session of Parliament, the scheme also including a junction with the Caledonian system at Alloa, which is in the adjoining county of Clackmannan.

Professor James A. Ewing, F.R.S., who has been professor of engineering in University College, Dundee, during the past seven years, has been appointed Professor of Electrical and Mechanical Engineering at Cambridge, in room of Professor Stewart, M.P. Professor Ewing is a native of Dundee, and previous to his appointment there was Professor of Engineering in the Imperial College, Tokio, Japan.

On November 13th there was launched from Messrs. Alex. Stephen & Son's yard, Dundee, the largest sailing vessel yet built in Dundee. She is a four-masted barque of 2,294 tons gross register.

ELLIOTT'S PATENT SMOKE ANNIHILATOR.

THE importance of getting rid of the smoke emitted from the combustion of coal, together with the attendant fumes, is a matter beyond question. The attempts made to abate this nuisance have been many, but hitherto the great drawback has been that none of them have proved a commercial success. While the subject under consideration is one more immediately affecting land interests than marine, yet we deem it of so much importance that it is with pleasure we bring under the notice of our readers the invention of Mr. Samuel Elliott, of Newbury, Berkshire, which seems to answer the purpose exactly. The apparatus, which he terms "a Smoke Annihilator," is to be seen in operation on the vacant land adjoining the City of London School, on the Thames Embankment, near the Temple. It occupies a space of a few feet only, and consists of a small fan worked to draw the smoke from the flue at a point near its base, and force it into a tank of water. The water in this tank is agitated by revolving stirrers, after the fashion of a dairy churn, driven by an engine, and the smoke is there so thoroughly washed that all the black carbonaceous matter is removed as well as the sulphur fumes, and nothing is returned to the flue but a white steam entirely devoid of any trace of smoke.

The annihilator can easily be attached to any shaft, funnel or chimney, and no stoppage of the works is necessary while so fixing, and it has the further advantage of allowing the very cheapest form of fuel to be burned without any smoke; a saving of a good round sum a year to large consumers. Further, the annihilator not only stops the nuisance of smoke, but it recovers the by-products, the value of which has not as yet been correctly arrived at, but we have such an authority as Sir William Siemens stating that they are worth twice as much as the original coal.

Mr. Elliott has his invention applied to a small steamer which runs on the Thames, and also to an ordinary factory chimney, and these work with certainty and success. The machine may be driven from existing shafting or by an auxiliary engine of small size, one H.P. being all that is necessary to work the annihilator effectually. The advantage of a quarter-deck free from smoke is a matter of great comfort, but it is when we come to consider the position of large manufacturing towns that we realize the full benefits that this invention confers.

Take the case of Manchester, for instance, the application of this machine to every factory or workshop shaft would mean the prevention of a settlement of over 300 tons per diem of residuum on housetops and vegetation. As to Sheffield, we fancy that figure must be at least doubled.

In the matter of giving us some chance of obtaining pure water it will be at once apparent that the annihilator is a great boon. So long as the atmosphere is contaminated with smoke, so long will it be impossible to obtain a drink of good water without the intervention of a filter.

We congratulate Mr. Elliott on the success attending the study and labour he has given in producing the "Annihilator"—most properly so called—and both on sea and land we hope to see it universally adopted, by Act of Parliament, if that be necessary.

The Bute Docks Amalgamation.—A meeting of the representative directors of the Bute Docks, Taff Vale Railway, and Barry Dock and Railway Companies was lately held in London for the purpose of considering the proposed amalgamation of the three undertakings. The proceedings were private, but we understand that it was decided to issue the usual Parliamentary notices of their intention to apply to Parliament for powers to bring about a fusion of the three companies named, while at the same time provision will be made for the inclusion of the Rhymney Railway Co. at some future time. The terms and conditions upon which this huge amalgamation will take place will not be made known until the Bill is deposited, but sufficient is known to enable us to state that it is intended that all the undertakings shall be controlled by one board, and provision will be made for the dissolution of the existing companies, or any of them, and for vesting in the amalgamated company the several undertakings. Powers will also be sought to authorize and confirm or give effect to agreements between either the companies as at present or the amalgamated company and the owners of any other railways, canals, or other property which it may be thought necessary to acquire either by purchase, amalgamation, or by working agreement for management and maintenance. In making provision for the amalgamation of the boards of directors of the existing companies the new company will ask for powers to elect certain members of the board otherwise than by shareholders.

HAYTHORN AND STUART'S PATENT PISTONS AND PISTON VALVE.

THE subject of the friction of pistons and slide valves in marine engines—is one too little discussed by marine engineers, friction being tacitly accepted as "a necessary evil." In the article referred to we venture to take exception to some features of the prevailing types of piston packing and slide valves, which may or may not accord with the ideas generally held on this subject by engineers.

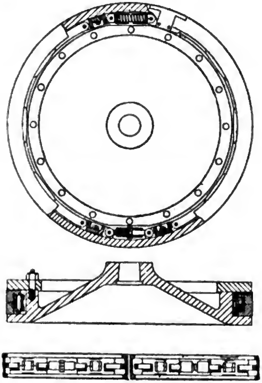


Fig. 1.

In any case the standard we set up is a high one; perhaps some may think, too high and ideal. We are pleased, however, here, to be able to submit testimony to the partial, if not entire, practicability of realizing the standard in question. The pistons and valves shown in the accompanying illustrations are the outcome of long experience with almost every other kind, and the makers—Messrs. Haythorn & Stuart, of Eastwood Engine Works, Glasgow—inform us that they have many hundreds in use working under every condition, and in all sizes up to about 100 in. diameter, in every case giving complete satisfaction. The requisite conditions for an efficient, durable, and easily adjustable piston have been carefully considered, and the experience of five years in making them has produced various improvements and modifications in detail. At first sight they may appear a little complex, but in reality they are very simple, and the parts being all in compression and practically motionless, there is absolutely no wear upon them.

Fig 1 is a plan, section and expansion of an ordinary marine piston for inverted cylinders. The packing consists of two strong rings of L section. These are expanded radially by a chain, consisting of flat wrought iron links and double cast-iron or brass pads alternately. At opposite sides these links give place to, on one side, a strong spiral spring contained in two half-boxes, and on the other an adjusting screw and nut. The link pads are in halves vertically, and between these, threaded on their brass connecting pins, and between one of them and the wrought-iron link, is a short spiral spring separating the half pads against the flanges of piston ring with a *constant pressure*. The adjusting screw forces the links round against their spring opposite, compressing it a *measurable distance* within the half-boxes, never more than 3-16ths or a quarter of an inch for the largest diameters. It will thus be seen that the vertical action is constant and just sufficient to produce steam-tight contact between the packing rings, junk ring and piston flange, and that the expanding pressure being applied through jointed links is transmitted radially and equally all round the packing rings.

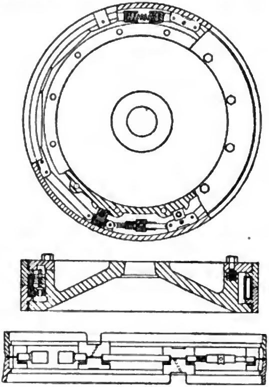


Fig. 2.

Fig 2 is a modification of the above for horizontal and diagonal engines, the expanding and vertical actions being the same. The packing rings, however, have their ends produced to the full depth of piston, the flange and junk ring being reduced in diameter to admit of this, thereby obtaining extra wearing surface. In addition to this, on the bottom side are two adjusting screws separating tapered nuts, which, working between two adjoining link pads and the body of piston, carry the weight of piston entirely upon the broad surface of packing rings, and are adjustable to any extent to compensate for wear, so that the body of piston and its rod can always be maintained in the original central position.

Fig. 3 is a modification suitable for smaller diameters and for high-pressure cylinders. In this case the packing ring is in one piece, having its ends prolonged as in Fig. 2, and with shallow grooves formed on outside to contain a water packing. There are no springs either for radial or vertical actions, the ring being expanded until it exactly fits the bore of cylinder, and the junk ring then screwed down, thus making it equivalent to a solid block. When this is applied to tandem, triple or quadruple engines in the upper cylinder, it forms the best possible guide for the rod; the lower cylinders in this instance having "floating" rings as in Fig. 1. This arrangement the makers inform us has been particularly successful, and in instances when it has replaced ordinary packing, wearing half-an-inch open in a voyage, its wear has been inappreciable.

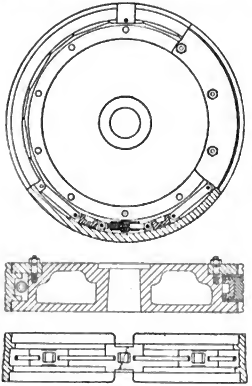


Fig. 3.

Fig. 4 shows vertical section and plan of piston valves, the upper half of section arranged as a solid or close valve and the lower one hollow, forming communication between top and bottom ends of valves. The arrangement of rings and adjustments is precisely similar to that of Fig. 3, the rings being adjusted to fit the valve chambers, and firmly secured. The outer ends being prolonged give both a free admission and exhaust. These valves can be readily arranged on the "Frick" principle, and from the fact of them being securely prevented from expanding, a multiple ported chamber is unnecessary. Only a sufficient number of ties to keep the chamber together are required, thus reducing the necessary diameter to contain the requisite port area.

The United States Navy.—Contracts for vessels to be built for the United States Government by the Cramp Co. foot up to £1,758,000.

THE DEVELOPMENT OF THE MARINE ENGINE, AND THE PROGRESS MADE IN MARINE ENGINEERING DURING THE PAST FIFTEEN YEARS.*

By A. E. Seaton, M.I.C.E., M.I.M.E., M. Council, I.N.A.

In this paper it will be my endeavour to trace the development of the marine engine and its appurtenances, and the general progress that has taken place in marine engineering generally during the past fifteen years, rather with the object of attributing much of it to the successful efforts of the members of this Institute in their various capacities, and thereby to render my thanks to them for the very valuable service they have contributed to my profession, than to tell of what has been achieved by the skill, ability, and perseverance of my colleagues in shipbuilding and engineering.

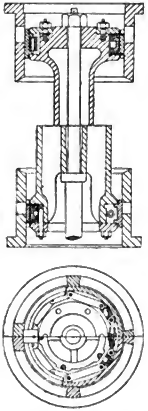


Fig. 4.

The engineer has been at all times dependent on the ironmaster, and on more than one occasion his progress has been barred by the inability of the latter to overcome some obstacle to success in his manufacture; but, on the other hand, it is equally true that the ironmaster has often been ahead of the engineer, and has been prepared, long beforehand, to supply that which would make a success for the marine engineer if he would avail himself of it. That eminent engineer and most fruitful of inventive geniuses, Trevithick, who, a century ago, saw instinctively what was possible with steam of high pressure, had to resort to sorry contrivances to try his experiments with the force he knew would be so useful. His boilers, made of copper tubes in granite tube plates, now might serve as a monument to his genius, and as an example of the straights to which he was by the circumstances of his time reduced, rather than as a proof of his ingenuity. It is true that since his day the tube or tubulous boiler has been employed successfully to generate steam of high pressure, and that therefore the boiler in question might be taken as another example of his prescience. It is nevertheless a fact that he did not succeed until the ironmaster of his day gave him iron plates, or, as we should be disposed to call them now, very broad bars. The dilemma that arose as to the shaft of the *Great Western* was removed by the genius of

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* Read at the meeting of the Iron and Steel Institute, Pittsburg, United States of America.

Nasmyth, an engineer; but the steam-hammer without the men to work a forge would have been a useless tool, and the cast-iron shaft would have had to take its chance; so that I infer that as much skill and invention were shown by those men who had to manipulate the iron with that hammer for the first time as was required to conceive, design, and make the hammer itself. History has not, therefore, been quite fair, for although she has recorded the one feat, and has justly recorded her tribute of praise to the inventor of the tool, so far as I am aware there is neither name nor praise recorded of the men who worked it, nor of the ironmaster who erected it. I do not mean to say that the circumstances are not known, but there are now very few men who could give the information, and although a comparatively short time has elapsed, their names are practically forgotten.

On the introduction of Siemens steel plates, the old Staffordshire list of extras was practically abandoned by steel makers. This had more to do with the progress subsequently made in boiler construction than the introduction of the material of superior strength, inasmuch as it made it possible to construct a boiler with the minimum number of plates at a less expense than one with almost the maximum number. The ironmaster could give us plates 9 ft. wide twenty or more years ago, but he wanted such a high price for them that no boiler-maker who worked in competition with his neighbours had the courage to use them, although I am of opinion that it would have paid to do so in all districts where labour was high. And that the boiler-maker did not use them was rather in consequence of his inability or disinclination to reckon the cost. At any rate, he did not employ large plates until they were practically the same price as small ones, and so boilers were constructed in the patchwork form until the era of Siemens-Martin steel. Here, as usual, it was the bugbear of cost that stopped progress, and this same bugbear does to this day often bar our way to the goal that some of us see so far off. You, gentlemen, have often proved yourselves to be our saviours, and we always look to you to remove the obstacles to progress that confront us, as also to the development of new departures. Without your help we would be at a standstill; with it we can advance step by step; and I am bound to say, in justice to you, that when we make clear our demand for some new thing, you always tackle the problem forthwith, and sooner or later give us what we need. We have not yet, however, exhausted the list of things we want, nor have you yet satisfied all our longings for the things we have asked for. When you give us steel castings without blowholes, steel forgings absolutely free from hair-marks an eighth of an inch below the surface, steel plates that know nothing of the "blue black" state, and that will not give way under any circumstances at a less strain than that to which they have been tested, we will not only be very grateful to you, but will ask for something else that shall give you the enjoyment of exercising your inventive genius, and that splendid patience with which I know you are all endowed.

The period chosen for consideration in this paper is one that embraces the genesis of the modern development of the marine engine and boiler; but it is, moreover, the time that has elapsed since the introduction of Siemens steel to which I attribute much of the progress that has recently been made. Prior to that time, iron was used almost exclusively in the construction of marine boilers, and very little steel indeed had been used in the engine. Boiler shells were made of Staffordshire iron plates, or of such other iron as was equal to it in both quality and price; the insides, such as furnaces and fireboxes, were made wholly or nearly so of what was familiarly known as "Lowmoor quality." The price of the latter was very high compared to that of the steel we now use, and may be taken as £30 per ton on the average. The Staffordshire iron would at that time average about £9 for a boiler made of comparatively small plates, and £12 for a boiler made by a more enterprising engineer with larger plates. There was practically no limit to the boiler pressure so far as the internal parts were concerned, but the working pressure was decidedly limited, in so far as it was governed by the shell. There were then some few firms that could supply a plate 1⅛ in. thick of fairly large dimensions, and in some very few instances plates as thick as 1¼ in. were used. Taking the former as the most common and also the most convenient thickness, it meant that a boiler 15 ft. diameter would pass only for a working pressure of 75 lbs., or if 100 lbs. pressure was required, the limit to diameter was 11 ft. 3 in. for single-ended boilers, and something less for double-ended ones. For a pressure of 150 lbs. the diameter would have been only 7 ft. 6 in. Now, it need not be urged that this was prohibitive of higher pressures, although it had such an effect indirectly, inasmuch as the stays, &c., being of iron, too, would have been either of monstrous size or so close together as to render the construction impracticable. The weight of such boilers was also very much against them, and altogether it required more courage than then existed, and certainly less caution than then obtained, to attempt such strides as have been since successfully accomplished. I have stated that there was no theoretical difficulty with the insides of the boilers, but, as a matter of fact, there were some practical difficulties to encounter. Lowmoor iron was especially liable to blister from innumerable laminations when exposed to heat, and these blisters caused trouble enough with the pressures and temperatures then ruling. What the troubles might have been with the thicker plates, higher pressures, and higher temperatures were not known, and, like all unknown terrors, were feared most. There were also means well known for stiffening the furnace so as to withstand higher pressures; but these very means were also often sources of mischief, and always feared as likely to lead to accidents. It is true that we had the locomotive boiler working at pressures far beyond that of the ordinary marine boiler, but marine engineers were very chary of trusting to it, and events proved that their suspicions were not without foundation; for even now that the locomotive boiler has been used on shipboard to a considerable extent, its success on the sea has been decidedly qualified, and no one will use it unless circumstances compel him, and then only when he can get a supply of fresh water.

The supply of a material possessing all the good qualities of Lowmoor iron, without its bad ones, enabled Mr. Samson Fox, and subsequently others, to weld a cylindrical tube of almost any size, and so manipulate it by corrugating or raising ridges as to render it proof against the pressures we now require. Thus was the internal difficulty got over. That same material had an ultimate tensile strength fully 30 per cent. higher than that of the iron used in the boiler shell, and in addition was of such a nature as to permit of manipulations unknown with that material, and its price is no higher than that of Staffordshire iron. A boiler made wholly of this steel was cheaper, lighter, and better designed and manufactured than one of the older material when of the same dimensions and for the same pressure. Natural conservatism, or some other occult force, seems to have prevented the marine engineer from taking the full advantage of the splendid substitute you gentlemen were prepared to supply him with. I must not forget, however, that there was another force, which is one of the strongest we have in our professional work to combat, that was decidedly opposed to the new material; that was prejudice. I feel even now tempted to take up the cudgels against that old enemy of the engineer, but in this case it would be waste of energy to thrash, as the dog is dead.

So far this was the condition of affairs when fresh demands began to be made on the marine engineer. The shipping world had had demonstrated to it that it was possible to cross the Atlantic at a higher speed than 13 knots; and that the ships possessing this higher speed did their voyages regularly, and, according to rumour, were paying. Certainly, both the American and the British public showed a preference for them, and there was a growing taste for speed at sea as there had been on land. The Inman and White Star Companies had shown that 15 knots was not only possible, but could be done with commercial success. But it was urged that to get this speed the ships must be very large, costly in construction, and very expensive in maintenance. This was quite true, and it remained to be seen if they would pay when there were more of them, with the consequent competition. The *Britannic* was built of iron, had iron boilers, and was propelled by ordinary compound engines. She has been a very successful ship in every sense of the word, and holds her own to-day; but her speed is no more than 15 knots still, and so she has to depend on something besides speed for a character now. She is a ship built prior to my period, and need be no further discussed; she is only taken as one of the causes which made a new demand.

That demand was for more speed. Now, with the same conditions, more speed meant with any ship more I.H.P., more coal, larger boilers, and finally, to get the speed economically, finer lines; in other words, less ability to carry the heavier weights entailed by the greater power. The *Arizona* was the first supply to this new demand. Iron was the material used, the compound engine the moving machine. The result was a gain of two knots per hour, equal to 13 per cent., with an increase in coal consumption of 50 per cent.; the carrying capacity for the size of the ship was considerably less, the tonnage under deck being only 5 per cent. more. It will be seen that the cost of this excess of two knots was very great, first in the larger ship, then in the larger engines, then in the increased consumption of fuel; also that, owing to the extra weight of, and space occupied by the machinery, together with the extra coal to be carried in the bunkers, the new ship was less able to earn sufficient freight to meet the expenses of the older ship, and still less able to meet her own. It is therefore evident that such a ship must depend almost entirely on passengers and light goods of high value, to enable her to be run profitably.

In spite of all these serious disadvantages, the demand for such ships continue, so that the *Arizona* was soon followed by the *Oregon* and *Alaska*, still larger and faster ships. These were followed by the *Servia*, *City of Rome*, and *America*. Then came the *Aurania*, *Umbria*, and *Etruria*; and finally we have the *City of New York*, *City of Paris*, *Teutonic*, and *Majestic* of 10,000 tons, and doing 20 knots per hour on the Atlantic regularly. These were the supplies that marine engineers and shipbuilders gave to the demand for more speed. In fifteen years the speed has been increased from 13 knots to 20, and there is no reason to doubt that these ships pay very well in spite of their enormous cost and working expenses. Such ships are not only made to pay, but are actually only possible by what has been done by the members of this Institute. Without steel in both ship and machinery, such ships could not be built to accomplish the speed, or to safely withstand the strain of sea and machinery.

The *Britannic* was built of iron, had iron boilers, and her engines were made more or less of iron in one form or the other. The *City of New York* is built of steel, has steel boilers, and her engines are to a very large extent built of steel. The saving in weight by the use of steel is very considerable in both ship and machinery, which admits of more cargo being carried, or of the lines of the ship being finer, so that a higher speed is possible with the same horse-power, or the same speed with a less horse-power and less consumption of coal.

Having thus briefly sketched out the origin and history of the demand for more speed in the Atlantic service, I will pass from this part of my subject with the observation that if the owners or managers of ships in that trade had been well advised, they would long ago have separated the passenger from the goods trade. A steamer for passenger service only could have been built for the speeds now attained at far less cost in every sense of the word. It is only those who have to work out some of the problems set them by shipowners that appear to know, and to appreciate, the tremendous cost that is paid for the ability to carry the few hundreds of tons of cargo possessed by the "Atlantic Greyhounds."

In 1875 there were many ships in the British Navy capable of doing 15 knots per hour on trial trips, but very few that could maintain that speed at sea. The necessity of having ships that could maintain that speed existed as soon as the mercantile ships of Great Britain could accomplish it; for not only would it be required that in time of war such ships should be convoyed, but the possibility of an enemy possessing such ships with which to harass the trade of the country was apparent. There was also the necessity for unarmoured cruisers to possess a superior speed to battle-ships for obvious reasons, and to act efficiently as sea-police they must have a speed superior to that of any ordinary ship afloat. Hence the demand for better speed in Her Majesty's Navy.

The competition among the various steamship companies running in connection with railway routes, and others in competition with railway routes, caused a demand for an increase of speed for a different class of ships. In fact, in every direction there existed a demand for more speed, so that there was every incentive to the shipbuilder and engineer to exercise his keenest wit in devising new ways of accomplishing this desirable end.

It will now be my task to show how this has been accomplished by the marine engineer, so that the public can now travel at higher speed, with greater safety, with increased comfort, and at no higher cost, than obtained on the ocean fifteen years ago.

I have stated that one way of obtaining speed was by making ships with finer lines, and this always had to be done at a considerable sacrifice of carrying power. Steel has, however, to a large extent obviated the necessity for such a sacrifice. New methods of construction and new forms of material have also tended to this end. Ironmasters now supply at reasonable rates bars of Z section, whereby the framework of the ship is much lighter, and at the same time stronger, than the old combination of angle bars. Then, too, this splendid steel that you now give us is capable of being so flanged, and that, too, when cold, that there no longer exists the necessity of riveting to the plate an angle bar, if it is sought to stiffen it, or to connect it to other work. You supply us now with such materials at practically no extra cost, that we can construct our ships with much fewer plates, whereby we avoid the cost, weight, and disadvantage of so many joints. You are no doubt told from time to time that this new material serious fault—that with all its good qualities it is not so the older one. This has a sufficient foundation of truth e opposition to it powerful; but with very ordinary precaution and care experience has shown that it can have the same endurance; and there is no doubt that with a better knowledge of how to treat it, this objection will entirely disappear, just as the same objection to iron ships existed, and has now been almost forgotten. The best remedy is to get rid of the mill scale before painting.

But while admitting that the naval architect has done much to bring about a successful solution of the speed problem, I must maintain that the marine engineer has done more. His path was not so obvious nor so clear before him, and new openings have often show themselves in unexpected places.

Whether the marine engineer starts with a fixed weight given him by the naval architect, or whether the latter accepts such from the former, and designs the ship accordingly, is immaterial. The fact remains that the engineer, in order to get the minimum power, must get each individual horse-power with the maximum of weight, in order that the ship may be a success; and his problem has been how to do this without adopting too costly processes.

His first step in this direction was comparatively obvious. An engine develops so much horse-power at each revolution. If it can be made to do 60 per minute instead of 50, the gain in power is 20 per cent.; and if the speed was at first 13 knots, it should now be 13·8 knots, or a gain of nearly a knot per hour. But how can we get this increase in the number of revolutions, and is it to be done economically? So far as the engines are concerned, it would mean an increase to the condenser only; and seeing that nearly all steamers at the date in question had too much cooling surface, it would probably have required no increase at all. But we must require more steam for this increase of power; certainly, and so the engineer of that day had to fit larger boilers to his ship. With large ocean steamers this was always possible, but for the smaller steamer it was not always possible, neither was it possible for the small steamer to carry the extra fuel. It is not necessary here to go into details, but it is a fact that the insuperable difficulty with this class in the endeavour to obtain more speed was the impossibility of obtaining sufficient space for the necessary boilers. Some other engineer would, however, attempt the increased number of revolutions by using steam of much higher pressure, trusting to its superior efficiency, for the paucity of supply. If his engines were able to digest, so to speak, this superior article, and to make full use of its superior efficiency, he was undoubtedly on the right track. Hence, the success of the *Arizona* and the ships that followed her was due to these simple departures. Later your steel admitted of still higher pressures being obtained from the boilers of succeeding ships, and the three-cylinder ordinary compound engines admitted of a higher rate of expansion without any practical drawbacks, as would have been the case with the four-cylinder compound engines of the *Britannic*. The possibility of constructing boilers for higher pressures by the introduction of Siemens-Martin steel, and that such boilers cost less money than the old iron ones, tempted some engineers to use steam at a pressure of 110 lbs. in the ordinary two-cylinder compound engine, but with disappointing results. I am aware that this experiment of ten or twelve years ago has been tried again, and that its new foster-parents state that the system gives as good results as the triple-expansion system. They deceive only themselves, and the evidence they give, so far as I have heard it, is conclusive of only one thing, and that is that the new boilers and better arrangement of cylinders that they have adopted now give better results than those they followed formerly. I was quite prepared to hear that the substitution of two cylinders for four, and the use of steam at 150 lbs. pressure expanding ten times would give better results than steam of 60 lbs. expanded only six times; this is what really has been proved, and no more.

Having accomplished so much as I have stated, it remained for the engineer to follow the path on which he had found so much success, and we soon found him running even these large engines at 80 revolutions. Taking, as before, the increased power as proportional, viz., 60 per cent., the speed should now be 15·25 knots instead of 13. Revolutions have now done for him as much as he thinks prudent, so he has to start in a new direction, and this time it is in the nature of an enlargement of the engines. His brother engineer of the Naval Board has had to do this long ago, because he had started with a much higher number of revolutions, —in fact, the mercantile engineer is taking up what the naval had left off. The naval engineer, however, is circumscribed in a way not unknown to the mercantile; he can only increase the size of the engine by an increase in the number of the cylinders, or in the diameter of them. He has tried the former since 1867, and until the compound engines forced themselves on him, Maudslay's three-cylinder engines had given him satisfaction, qualified, it is true, owing to a troublesome valve gearing. The mercantile engineer, filled with gratitude for what speed of piston had done for him, now sees his way to getting a still higher speed by lengthening the stroke, so that in 1886 he is getting close to the thousand feet per minute, with engines whose topmost part is visible from the deck without craning the neck through the skylight. Steam is supplied to the monster by numerous huge steel boilers, and the ship can carry little more than her fuel supply for the single voyage.

But before this climax has been reached, a veteran engineer has turned once more to an old idea of his own. His first experiment with it had, through no fault of it or him, failed. He finds that with this new good steel he can now build a boiler of a type well known and tried, and thereby get steam of the pressure he requires with certainty and safety; and in 1881 Dr. Kirk astonishes the shipping world by the success of the *Aberdeen*, having similar engines to the *Propontis*, made by him in 1874, but which failed. And why were the owners of ships so interested in the success of the *Aberdeen* and what after all was her success? The steam pressure in her was very little higher than some others were then using, being only 125 lbs., and at that time coal was as cheap as it had ever been; so that, although economy in its use was and always is of importance, it was not so much so as to cause a revolution so sudden and complete as that which followed. The fact is, here was the real solution of the speed question.

Since, then, we have all learnt that the triple engine burns less coal, can be run at a higher speed, and has less bulky boilers to supply it with steam than the old compounds, and that was what we were all wanting to obtain, higher speed in every class of ship, even in the so-called ocean tramps, which now glory in a ten-knot speed, whereas formerly the skipper was a proud man who could maintain a level eight knots throughout the voyage. The success, however, of the *Aberdeen* was something more even than this; here was a ship of moderate size, good speed, and good carrying capacity, that was going to do a very long voyage by a route where the coaling stations were far apart, and at some of them the coal very dear. Shipowners could now see before them fresh fields for enterprise, and the sailing shipowner learnt before long that this same Dr. Kirk had created poachers on the realm so long held by him. The sailing ship has not been driven off the high seas, but steamers now run on tracks unknown to them till the triple engine existed.

The failure, in 1874, of the *Propontis* was therefore due to the want of a suitable material for boiler-making, which by 1881 you gentlemen had supplied to us, and permitted such a success to her designer that the trade of the world has been thereby revolutionised. The saving of fuel has been stated, challenged, debated, and discussed *ad nauseam*. The fact remains that it is substantial, and is approximately 20 per cent. where all other conditions are the same. Experience has proved that the three-crank engine is capable of being run at higher speeds than the two-crank one, and that its wear and tear is absolutely less. The boilers being required to supply 20 per cent. less steam, can, of course, be 20 per cent. less; or the same size of boiler will supply steam for 20 per cent. more power. This latter fact was the one made more use of by the generality of shipowners, partly by design, but oftener by unbelief. Hence the superior speed of many of the "tramps" is due to the latter; that of small passenger steamers almost wholly to the former.

On the whole, the saving of coal by means of the triple-compound engine has been rather in the direction of the allowance per H.P. than per ton carried, as the ton carried is almost universally carried now at a higher speed. The actual saving is nevertheless a very substantial one, both to the world and to the individual shipowner, for a ship, if run at a higher speed, makes more voyages in a year, so that the trade is done with less capital, which means less tonnage. The demand for less tonnage no doubt depresses the freight rates, and so the unfortunate shipowner does not reap the harvest, but only as it is shared by the public at large. The continued depression in shipping is undoubtedly due to Dr. Kirk's genius, and hence he gets so little praise.

Mr. Thornycroft,[*] now so well known as the designer and builder of steam-launches, and, later, of torpedo-boats, soon had to give up non-condensing engines and condense the steam so as to get fresh water for feeding the locomotive boilers he used. The loss of means of draught in the escape steam caused him to substitute artificial sources of air supply, and he found that by forcing air under the grates he could get an increase of steam supply over that given formerly by the steam-blast. The pressure of air was increased from the half-inch to as much as 6 in. of water, corresponding to that of the fiercest draught of an express locomotive; the supply of steam was excellent, and the speed obtained with a steam-launch of considerable size and torpedo-boats larger still was very high, and was at the time considered marvellous. The means whereby these improved results were got were in themselves simple and inexpensive. The compartment containing the boilers was made air-tight, and into it was forced a supply of air from the deck by means of one or more fans of the ordinary type, driven by an independent engine. The simplicity of these means, and the success attending the experiments, led our naval engineers in 1880 to adopt them on a large scale in some cruisers of the *Leander* class, the result being that with precisely the same engines and boilers, and with only the addition of the forced draught arrangement, a considerable increase of speed was achieved. Since that date, similar forced draught arrangements have been fitted to all the new ships built for the British Navy, and the example thus set has been followed by the engineers of other countries.

As an illustration of what can be done in this way, it is sufficient to instance the case of the first-class belted cruisers of the *Immortalité* class. When working under natural draught, the power to be indicated was 5,500 horses, and on the trial trip as much as 6,000 H.P. was developed. With forced draught, due to an air pressure equal to two inches of water, it was expected that 8,500 horses would be developed by the engines; but, as a matter of fact, on the trial trip and under these conditions over 9,000 H.P. was obtained, and the speed was raised from 16½ knots to 19 knots. At the present time, speeds of 20 knots per hour are being realised in Her Majesty's Navy with engines and boilers of such a size as ten years ago would have been deemed sufficient for a speed of only 15 knots. It is, however, I regret to say, a fact that now a considerable difficulty is being experienced by those having to do with machinery for the English Navy in running continuously under forced draught without more or less trouble with the boilers. This is not, in my opinion, due to the system, but to the want of suitable provision in the boiler design for the conditions under which they have to work when being pressed to the utmost. It is, in fact, a little error of judgment on the part of the authorities into which they have been led by the perfect success of their previous efforts in the same direction; and just as the locomotive engineer of to-day is dependent on, and has the utmost faith in, the forced draught by which he gets express speeds, so the marine engineer will get over his difficulties as the locomotive engineer did, so that in the near future we shall see ships whose boilers are worked under forced draught with perfect safety and confidence doing express speeds.

In the days of natural draught and compound engines, 10 H.P. per square foot of grate was thought to be a good output; with the introduction of the triple engine and higher pressures a natural draught would give 14 to 15 H.P. per square foot of grate; and the modern forced draught now in use in large ships enables us to get 20 H.P. per square foot of grate; and in smaller boats, where the air-pressure in the stokeholes has been raised about two inches, even higher results have been reached.

With the success of the principle of forced draught came the usual number of enterprising inventors with their inventions, some of them good, some of them not worthy of notice, but all of them more or less misunderstood so far as the objects aimed at and the end to be obtained were concerned. As a means to a particular end, forced draught has been a success; as a means to the several ends had in view by experimenters, it has not been a success. When the consumption of a larger amount of fuel per square foot of grate with a consequent increase in the supply of steam was the object, no one could complain; but that there should be an economy of fuel per horse-power was not to be expected, although it is true that with some kinds of coal, and in some kinds of boilers, the more rapid combustion, and the more intense heat obtained, have been attended with a slight economy in consumption. It is claimed by certain inventors that by their patents economy is effected, inasmuch as the air forced into the furnaces is to some extent heated by the waste gases in the uptake and funnel; but seeing how low the specific heat of air is and the short time to which it is exposed to the heating process, it is very doubtful if the gain would outweigh some of the disadvantages of the system; and, on the whole, I am inclined to think that our Admiralty system of closed stokeholes is the best, and that economy must be sought in the better firing than is possible under these conditions than to the heating of the air supply—not that I by any means undervalue the advantage of the regenerative process.

(To be continued.)

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[*] I have given Mr. Thornycroft the credit of the modern application of forced or artificial draught, but the fact is that the first attempt in this direction was made by Ericson in 1828 to the steamer *Victory*, commanded by Sir John Ross, and, strange to say, he enters in his log that "the boiler still continued to leak, although we had put dung and potatoes in it, as directed by the engineers."

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Chelydra.—On October 25th there was launched by Messrs. Joseph L. Thompson & Sons, at North Sands, Sunderland, a steel steamer, built to the order of Mr. Cuthbert Hutchinson, of Rock Lodge, Monkwearmouth. The vessel is of the following dimensions:—Length, between perpendiculars, 316 ft.; breadth, 40 ft. 6 in.; depth of hold, 21 ft.; having a deadweight capacity of 4,200 tons. The engines are of the triple-expansion type, the cylinders being 23 in., 38 in., and 62·5 in. respectively, with a stroke of 42 in., and are being built by Messrs. Blair & Co., Limited, of Stockton. The vessel was named the *Chelydra*.

Chicago.—On October 25th there was launched from the yard of Messrs. Short Bros., at Sunderland, a steel screw steamship, built to the order of the Neptune Steam Navigation Co., Limited, of Sunderland, for service to the United States of America. The vessel is of about 3,600 tons burden, and her principal registered dimensions are:—Length, between perpendiculars, 293 ft.; breadth, 39 ft.; depth of hold to ordinary floors, 27 ft. 6 in.; the height of 'tween decks being 7 ft. clear. She will be fitted with triple-expansion engines by Messrs. Geo. Clark, Limited, of Sunderland; and is fitted with patent direct steam capstan windlass by Emerson, Walker & Thompson Brothers, Limited. The ship was named the *Chicago* by Mrs. William Pinkney.

N. Verberckmoes.—On October 25th there was launched from the West Docks Shipbuilding Yard of Messrs. John Readhead & Sons, South Shields, a steel screw steamer of the following dimensions, viz., 253 ft. by 33 ft. by 23 ft., being a spar-decked vessel, with bridge amidships for the accommodation of officers and crew. She is classed at Bureau Veritas, and is fitted with four steam winches, water ballast on the cellular system, Clark, Chapman & Co.'s patent windlass, and all the latest appliances and improvements to fit the vessel for wine and general cargo trades. The machinery, also built by Messrs. John Readhead & Sons, is of the triple-expansion type, having cylinders 20½ in. by 33½ in. by 55 in., with 36 in. stroke; and is supplied with steam from two steel boilers at a pressure of 160 lbs. per square inch. The steamer has been built to the order of the Compagnie Générale de Bateaux à Vapeur à Helase du Nord, Dunkirk, and is the eighth steamer built by Messrs. Readhead for this company. The company is represented by Mr. Frederick Morel, who was present at the launch, the vessel being named the *N. Verberckmoes*.

Sirius.—On October 27th there was launched, at the Elswick Shipyard of Sir W. G. Armstrong, Mitchell & Co., the *Sirius*, a second-class cruiser for Her Majesty's Navy. The following is a description of the vessel:—Length, 300ft.; breadth, 43ft. 8in.; mean draught, 17ft. 6in.; displacement, 3,600 tons; I.H.P., 9,000; speed, 20 knots; coal supply, 400 tons; armament, two 6in. rapid-firing guns, six 4¾in. ditto, eight 6-pounder ditto, one 3-pounder ditto, one 9-pounder field and boat gun, four torpedo guns; protective deck 2in. on slopes and 1in. on flats, *glacis* armour-plate protecting the engine cylinders 5in. thick. There was a large attendance of spectators at the launching ceremony, including Earl Percy, Lady Louisa Percy, Captain Noble, C.B., Mr. P. Watts, and Mr. Black. The religious service was read by the Rev. Canon Lintott, and the cruiser as it left the ways was named the *Sirius* by Lady Louisa Percy. The vessel was designed by Mr. W. H. White, of the Admiralty.

Aquitaine.—On Tuesday, October 28th, there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a large steel screw steamer, built to the order of the Societé Generale de Transports Maritimes à Vapeur, of Marseilles. The dimensions of the vessel are:—Length, between perpendiculars, 350 ft.; breadth, extreme, 42 ft. 6 in.; depth, moulded, 29 ft.; and is built to the spar deck rule with full poop, long bridge and topgallant forecastle; she will take the highest class at both Lloyd's and Bureau Veritas, and is constructed with Z frames, the bottom being on the cellular principle all fore and aft, the after tank is specially arranged for carrying fresh water for emigrants, boiler service, &c. The spar deck is of pine with a partial steel deck underneath, the main and lower deck are both of steel and the poop deck of teak, the main and lower decks will be fitted with berths for 1,200 emigrants, the beds for which are to be of the owners' special pattern in iron. In the poop aft there is accommodation for 20 first-class passengers, and the saloon is very handsomely fitted up in various shades of solid oak, relieved with gilt fluted pilasters of the same wood and bevelled plate-glass mirror in each alternate panel, and the whole of the hardware is in electro-plate; oak swivel chairs are fitted to all the tables, and the sideboard at the fore end of the saloon is in various kinds of hard woods. The baths, &c., are at the aft end of the poop and are handsomely fitted up. On the poop deck is a large smoking house, which also forms an entrance to the cabins and is entirely fitted out in teak. The second-class cabins are on the main deck immediately beneath the first-class saloon and contain berths for 40 passengers. The saloon, which is very large, extends the full width of the ship and is lighted by a large trunk skylight extending to the poop deck. All the officers' accommodation, and the bars, wine stores, restaurants, galleys, oven and bakehouses, &c., are beneath the bridge alongside of the engines and boilers. On the top of the bridge forward there is the steering house in the centre and the captain's house on the starboard side, and chart-house on the port side, each supporting the flying bridge. The firemen are placed amidships alongside the engine-room, and their quarters are fitted out complete with lavatories, &c., and iron beds. The waiters have similar quarters on the lower deck aft alongside the baggage department and in room. The mails and bullion are to be placed on the main deck abaft the after peak bulkhead. The crew are berthed under the spar deck forward, at which part are also the numerous and various store and provision rooms. Two large hospitals are fitted forward, one for men and one for women, also a mortuary has been built at this part of the ship. The winches on deck are four in number, all by Messrs. Clarke, Chapman & Co., and the steam steering gear is the "Harrison" gear, which is placed in the engine-room and worked by bevelled gear from the wheel-house forward. The engines are of the latest type and built by the North Eastern Marine Engineering Co., Limited, at Wallsend-on-Tyne. The cylinders are 28 in., 45 in. and 73 in. by 48 in. stroke, steam being supplied by two large double-ended boilers with 7,200 ft. of heating surface, and it is expected that a high rate of speed will be obtained, especially as the ship is on unusually fine lines. The donkey boiler is a horizontal one by Riley Bros., and is placed on the spar deck. The condenser for making fresh water is by Messrs. O. M. Row & Co., and the sanitary arrangements of the vessel are most complete in every detail. During construction the ship and engines have been surveyed on behalf of the owners by Mr. H. C. Ashlin, of London and Liverpool. On leaving the ways she was gracefully named *Aquitaine* by Mrs. Cohan, of Liverpool, wife of Mr. E. A. Cohan, of the firm of Messrs. H. E. Moss & Co., of London and Liverpool; Mr. Cohan also being the agent of the owners in this country. After the launch the vessel was towed into dock to be masted, and will proceed in a day or two to the Tyne for her engines.

Bawtry.—On October 28th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. Sivewright, Bacon & Co., of West Hartlepool, and of the following dimensions, viz.:—Length, 290 ft.; breadth, 38 ft.; depth, 22 ft. 6 in., and to class 100 A1 at Lloyd's, on the well-decked rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including four double-cylindered steam winches, direct acting steam windlass by Emerson, Walker & Co., large donkey boiler, steam steering gear by Messrs. Davis & Co., Limited, and Hastie's screw gear aft. The engines, which will be supplied by Messrs. Wallsend Slipway & Engineering Co., Limited, are of their usual excellent design, with all their latest improvements. On leaving the ways the vessel was gracefully named the *Bawtry* by Mrs. Dr. Salt, of Middlesbro'.

Gretchen Bohlen.—On October 28th there was launched from the Neptune Shipyard, at Walker, by Messrs. Wigham Richardson & Co., a small, finely-modelled screw steamer, which has been built to the order of the Afrikanische Dampfschiffs Actien Gesellschaft, Woermann Linie, of Hamburg, who intend it to form part of their fleet for their African service, being the second vessel built by Messrs. Wigham Richardson & Co., for this company. She is a steel vessel, 240 ft. long, and of very small draught, and will take the highest class in the Bureau Veritas classification. She will be provided with triple-expansion engines, which, with the boilers, are also being constructed by Messrs. Wigham Richardson & Co., and she will be furnished with a powerful steam windlass, steam steering gear, and steam winches. As the vessel left the ways she was named the *Gretchen Bohlen*, the ceremony being performed by Miss Dora Richardson, of Wingrove House, Newcastle. The construction of the hull, engines, and boilers is proceeding under the superintendence of Mr. Robert Pohl, of Hamburg. The keel of another vessel was laid in the berth that the *Gretchen Bohlen* had just left, in 30 minutes after the launch.

Uplands.—On October 28th Messrs. Ropner & Son, Stockton-on-Tees, launched a steel screw steamer named *Uplands*, built to the order of Messrs. Hardy, Wilson & Co., of West Hartlepool. Her dimensions are as follows:—Length, over all, 282 ft. 6 in.; breadth, 38 ft. 10 in.; depth, moulded, 21 ft. 11 in. She has been built to the highest class at Lloyd's, and is designed to carry 3,300 tons deadweight. She has a break poop in which is fitted a handsome saloon, with accommodation for captain and officers, raised quarter-deck, long bridges extending to foremast, shoot well, topgallant forecastle, cellular bottoms for water ballast, four steam winches, two donkey boilers, and steam steering gear, and Emerson, Walker & Co.'s patent horizontal direct steam windlass. Being built on the web-frame principle, her holds will give large stowage for cargo, and her outfit includes all the latest appliances for rapid loading and discharging. She will be fitted with triple-expansion engines by Messrs. Blair & Co., of 800 I.H.P., and two large steel boilers working at 160 lbs.

Stalheim.—On October 29th Messrs. J. Priestman & Co. launched at Southwick a steel screw steamer, built to the order of Messrs. Harloff & Boe, Bergen, Norway. The dimensions are:—Length, 300 ft.; breadth, extreme, 39 ft.; depth, moulded, 21 ft. 3 in. The engines are of the triple-expansion type, and are being supplied by Messrs. Hutson & Corbett, Kelvinhaugh Works, Glasgow, being of about 1,150 I.H.P. The vessel was named *Stalheim*.

St. Enoch.—On October 29th there was launched by Palmer's Shipbuilding and Iron Co., at Jarrow, a steel screw steamer, of the following dimensions:—Length, between perpendiculars, 375 ft.; breadth, 46 ft.; depth, moulded, 31 ft. 3 in. The vessel is built entirely of steel, manufactured by the Palmer Co. at their steel works. She has been built to carry over 6,000 tons on a mean draught of 24 ft. 7½ in. She is built on the spar-deck type, to be classed 100 A1 at Lloyd's, with additional scantlings over and above Lloyd's requirements. Water ballast tanks are constructed all fore and aft on the cellular principle, and have a capacity of over 1,000 tons. The vessel is rigged as a two-masted schooner, and is fitted up with a ponderous double derrick on each mast, with a view to the rapid loading and discharging of cargoes. In addition to this there is a steam windlass worked by an extra large horizontal donkey boiler. The vessel has been built to the order of Messrs. Rankin & Gilmore, of Liverpool, and was named the *St. Enoch* by Mrs. Innes, wife of Mr. Innes, resident inspector.

Zanzibar.—On Wednesday, October 29th Messrs. Edwd. Withy & Co. launched from their yard, at Hartlepool, a large steel screw steamer, built to the order of F. Woods, Esq., London. She is a fine type of a modern cargo boat, measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions and iron cargo bottom; all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors hauling up into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore and aft schooner. She will be fitted with triple-expansion engines by Messrs. W. Gray & Co., Limited, Central Marine Engine Works, West Hartlepool. The vessel was named *Zanzibar*.

Macduff.—On October 29th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of Messrs. J. Warrack & Co., of Leith. Her dimensions are:—Length, over all, 330 ft.; breadth, 40 ft. 6 in.; depth, 27 ft. She will take Lloyd's highest class, and is built to the "three decked rule," and has a steel main deck and iron upper deck sheathed with wood. The deck erections consist of a full poop, which will be used for carrying cargo; a long bridge containing saloon, passengers' state rooms, officers' and engineers' rooms, &c.; and a topgallant forecastle fitted up for firemen, sailors, and petty officers. The arrangements for working the ship and handling cargo will be of the most efficient kind, including patent direct steam windlass by Emerson, Walker & Co., steam steering gear, five steam winches, multitubular donkey boiler, two masts with double derricks, and schooner-rigged with double topsails. The small boats are according to the requirements of the Passengers' Life Saving Appliances Act, and have Mills's patent detaching gear. Fine triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, the cylinders are 23 in., 40 in., and 65 in. diameter, and the piston stroke 42 in. The boilers are of large size, and will work at a pressure of 160 lbs. per square inch. The ceremony of naming the new steamer *Macduff* was gracefully performed by Miss Butcher, of Edinburgh. The ship and machinery have been built under the superintendence of Captain M. J. Butcher and Mr. M. A. Hall respectively, on behalf of the owners. The *Macduff* will be employed in the China trade, and will be commanded by Captain W. H. Wood.

Francisco.—On October 29th there was launched from the shipbuilding yard of Messrs. Robert Stephenson & Co., Limited, at Hebburn, a very large cargo and passenger steamer, which has been built to the order of Messrs. Thos. Wilson, Sons & Co., Hull, and is intended for their Atlantic trade. She is the third vessel built and engined by Messrs. Stephenson for Messrs. Wilson's extensive fleet. The dimensions of the vessel are:—Length, 382 ft.; breadth, 46½ ft.; depth, 30½ ft. She has been built to the highest class at Lloyd's for both hull and machinery, and will have a Board of Trade passenger certificate. She is of the three-decked type, with a long poop, bridge, and forecastle. The hull is built of steel, the rudder and sternpost are both of cast steel, and the sternpost is scarthed in three places to facilitate repair in case of damage. The arrangements for rapid despatch in loading and unloading are of an exceptionally complete description, there being no fewer than 12 derricks and nine steam winches by Messrs. Amos & Smith, of Hull. A complete installation of the electric light will be fitted throughout the ship, and there are two systems for extinguishing fire in any part of the vessel—by steam, or by chemical or electrical apparatus. Stalls are fitted on the deck and in the 'tween decks for about 1,000 head of cattle, and very special arrangements have been made for the perfect ventilation of the ship in all compartments. There is a refrigerating machine and an insulated chamber for carrying fruit. The propelling machinery has been constructed by Messrs. Robert Stephenson & Co., Limited, at their engine works, Newcastle, and consists of a set of triple-expansion engines of over 3,000 I.H.P., having three cylinders 31½ in., 49 in., and 82 in. diameter respectively, with a piston stroke of 54 in. Steam is supplied from three double-ended boilers having a working pressure of 180 lbs. The vessel is of graceful model, with fine lines, suitable for the intended speed of 13 knots per hour. The machinery has been constructed under the supervision of Mr. John Spear, Messrs. Wilson's superintending engineer; and the hull has been surveyed during construction by Mr. J. F. Wilkins, superintending shipbuilder for the Wilson line of steamers. The vessel was named the *Francisco* by Miss Stephenson, daughter of one of the managing directors of the company.

Frogner.—On October 30th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. Fearnley & Eger, of Christiania, Norway. The principal dimensions are:—Length, 237 ft.; beam, 33 ft.; depth, moulded, 18 ft.; with a deadweight carrying capacity of 1,800 tons. The vessel is constructed on the raised quarter-deck system, with cellular double bottom fore and aft, and will take the highest class at Lloyd's, and also Norwegian Veritas. The cabins are arranged in a large house on the bridge deck; accommodation is provided for engineers and officers under aft end of bridge, and for crew in topgallant forecastle. Steam and hand steering gear are fitted on flying bridge and hand gear in wheel-house aft; and she is fitted with direct steam windlass by Emerson, Walker & Co. During construction the vessel has been superintended by Captain Gullicksen on behalf of the owners. The engines have also been built to Lloyd's and Norwegian Veritas requirements by the North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, and are on the triple-expansion principle, having cylinders 17 in., 28 in., and 46 in., with 33 in. stroke, capable of indicating 700 H.P., and propelling the ship at a speed of 9½ knots loaded. As the vessel left the ways she was named the *Frogner* by Miss Skinner.

Tosari.—On October 30th Messrs. C. S. Swan & Hunter launched from their shipbuilding yard at Wallsend-on-Tyne a steel screw passenger steamer, built to the order of Messrs the Deutsche Dampfschiff Rhederei, of Hamburg, for their newly-inaugurated Sunda Line between Hamburg, Rotterdam, Java, and adjacent ports. The vessel is 312 ft. long over all, by 41 ft. broad, by 24 ft. depth, moulded, with long full poop, long bridge-house amidships, the bridge and poop being connected by a wide house with extended deck to side, the whole of the poop and house is occupied by first-class passenger accommodation. There will be a handsome dining-saloon fitted full breadth of the ship, ladies' boudoir handsomely fitted up, very large state-rooms with iron folding beds, folding lavatories, &c., all recent improvements, surgery, barbers' shops, mail-room, tiled lavatories, bullion-room, &c. In the poop deck entrance house there will be a handsome music-room with piano, stained-glass windows and dome skylights, also smoking-room fitted in marble panels. Topgallant forecastle is comfortably fitted up to accommodate the crew, petty officers, &c., under which will be large store-rooms and ice-room for storing provisions. Electric light will be fitted throughout. The vessel has cellular double bottom all fore and aft, and will be fitted with all the latest improvements for the rapid loading and discharging of cargo. The engines are by the Wallsend Slipway and Engineering Co., Limited, Wallsend, and are capable of indicating 2,250 H.P. The vessel is built on exceedingly fine lines, and a high rate of speed is expected to be obtained. During construction the hull has been under the superintendence of Captain Schultz, and engines under Mr. Heuert. The vessel will have the highest class at Lloyd's, built under special survey, and in accordance also with German laws. She was named the *Tosari* by Miss Dora Hodge, sister to Mr. Rowland Hodge, manager for the builders.

Fastnet.—On October 30th Messrs. Edward Finch & Co., Limited, Chepstow, launched from their shipbuilding yard the iron screw tug *Fastnet*, built to the order of Messrs. Christie & Co., of Cardiff. Her dimensions are:—Length, between perpendiculars, 75 ft; breadth, 15 ft.; depth, moulded, 9 ft. 6 in. She has been built under special survey to class 100 A for towing purposes in Lloyd's register. Her machinery consists of a pair of compound surface condensing engines, diameter high-pressure cylinder 15 in., low-pressure cylinder 30 in., stroke 20 in., working at a boiler pressure of 100 lbs. per square inch. She has large coal bunkers amidships, making her capable of undertaking long sea towing. This is the fourth boat Messrs. Finch & Co. have made for the same owners.

Progress.—On October 30th there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis & Co., Wallsend, a handsomely-modelled steel screw steamer, built to the order of Severin Larssen, Esq., of Drammen, Norway. Her principal dimensions are as follow:—Length, between perpendiculars, 196 ft. 6 in.; breadth, moulded, 30 ft. 6 in.; depth, moulded, 13 ft. 9 in. The vessel has been built to take the highest class in the Norwegian Veritas, the surveyor for England being Mr. Lauritz M. Boden, of Sunderland. She is built with a long raised quarter-deck, bridge, and topgallant forecastle, and is rigged as a two-masted schooner. She is fitted in the holds and peaks for water ballast. All the most modern improvements have been introduced for the rapid loading and discharging of cargo; and she carries patent capstan windlass by Emerson, Walker & Co. Accommodation for the captain and officers is provided under the bridge deck amidships; the crew being berthed under the topgallant forecastle. The vessel will be fitted with triple-expansion engines, with cylinders 16 in., 26 in. and 43 in. diameter by 30 in. stroke, and steel boilers by the North-Eastern Marine Engineering Co., Limited. Drammen has been long known as a port where sailing vessels are owned, but this is the first steam vessel belonging to that port. During construction the work has been superintended by Captain Syvertsen on behalf of the owner. Amongst other persons present at the launch were Mr. and Mrs. Charles Matthiessen and Mr. Hansen, of Christiania, Mr. Wange, of the firm of Messrs. P. H. Matthiessen & Co., the agent in England of the owner, Captain Syvertsen, Captain Andersen, Mr. Beck, of Tynemouth, &c., &c. The vessel was named the *Progress* by Mrs. Chas. Matthiessen.

Frieda.—On October 31st Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, built to the order of Otto Trechmann, Esq., of West Hartlepool. The vessel will take Lloyd's highest class Her dimensions are:—Length, over all, 285 ft.; breadth, 37 ft. 2 in.; depth, 21 ft. 10 in. The deck erections consist of a poop, raised quarter-deck, long bridge, and topgallant forecastle. The saloon and cabins are aft, the engineers' rooms amidships, and the crew's accommodation in the fore part of the bridge The hull is built on the web-frame system. Large hatchways are fitted, four steam winches, steam-steering gear amidships, screw gear aft, two donkey boilers and patent windlass by Emerson, Walker & Co.; boats on beams overhead, two masts with fore-and-aft rig, and all modern working appliances will be fitted for general trading. The central marine engineering works of W. Gray & Co., Limited, supply fine triple-expansion engines having cylinders 21½ in., 34 in. and 57 in. diameter, with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The ship has been superintended during construction by Mr. J. Burns, on behalf of the owners. She was gracefully christened *Frieda* by Miss Hilda Trechmann, Cliff Terrace, Hartlepool.

Lightship.—On October 31st Mr. John Smirthwaite launched at Hull a new lightship, intended for the Hull Trinity House. The new boat, which is built of oak, measures 59 ft. in length, 16 ft. across the beam, and is 8 ft. 6 in. deep, and she is intended to be placed on the Hessle Sand.

Cabo Silleiro.—On November 12th there was launched at Sunderland by Messrs. Joseph L. Thompson & Sons, a steel steamer built to the order of Messrs. Ybarra y Cia., of Seville. The engines are being supplied by Messrs. Blair & Co., and are of the triple-expansion type, having cylinders 15½ in., 26 in., and 42 in. respectively, with a stroke of 30 in. The vessel was named *Cabo Silleire.*

Steel Screw Steamer.—On November 12th Messrs. Richardson, Duck & Co. launched from their building yard a steel screw steamer, their No. 378, of the following dimensions, viz.:—Length over all, 317 ft. 3 in.; breadth, extreme, 41 ft.; depth, moulded, 23 ft. 7 in.; tonnage gross, about 2,950 tons. This vessel has a half poop for captain and mate's accommodation. Raised quarter-deck to engine-room bulkhead, and a partial awning deck from engine-room bulkhead to stem. The engineers are berthed in a house on quarter-deck, and the crew's quarters are in forecastle. Water ballast on cellular principle is fitted fore and aft. She will have five steam winches, steam windlass, steam steering gear, lighthouses, and every modern appliance for the speedy loading and discharging of the vessel. Engines are by Messrs. T. Richardson & Sons, and have cylinders 22½ in., 37 in. and 61 in. by 39 in. stroke; two boilers, working at 160 lbs. pressure.

Gladys.—On November 13th there was launched by Messrs S. P. Austin & Son, Sunderland, a screw steamer of about 3,300 tons deadweight capacity, constructed throughout of steel, under special survey at Lloyd's, to class 100 A1, with full poop, raised quarter-deck, partial awning deck, complete cellular bottom for water ballast, and steel masts. She will be fitted with triple-expansion machinery of 210 N.H.P. She has been built to the order of Messrs. John Coverdale & Son, West Hartlepool, and was named *Gladys.*

Hiroshima Maru.—On Thursday afternoon, November 13th there was successfully launched by Messrs. Robert Thompson & Sons, from their Southwick yard, Sunderland, a steel screw steamer, intended for the Clippon Yusen Kaisha Steamship Co., of Tokio, Japan. The following are her dimensions and particulars, viz.:—Length, 331 ft. 6 in.; breadth, 42 ft.; and depth of hold, to Lloyd's floors, 28 ft. 9 in.; built under special survey to class 100 A1 at Lloyd's, under the spar-deck rules, with cellular double bottom all fore and aft, and a large deep water ballast tank, fitted in main hold, which can also be used for cargo. There are six bulkheads carried up to spar deck, four large hatchways, with cargo ports in 'tween decks opposite each, sidelights fitted fore and aft in 'tween decks.

four steam winches with multitubular donkey boiler, exhaust from winches discharges into tank in stokehole, patent steam and hand combined steering gear amidships, screw gear aft, direct acting steam windlass, boats fitted up in accordance with Board of Trade new Act, and all the most modern improvements. A large deck-house is fitted aft, with cape covering the stern, the house being fitted up for the accommodation of captain and first-class passengers. Under the bridge amidships are berths for the officers and engineers, purser, &c.; European and Japanese galleys fitted with a large rice boiler forward, and forecastle accommodation is provided for quartermasters, crew, and firemen, with wash-houses, &c. All berths throughout the vessel are heated by steam. The engines, by the North-Eastern Marine Engineering Co., Wallsend, have cylinders 25 in., 40 in., and 66 in., with 45 in. stroke, and boilers 12 ft. 6 in. by 15 ft. 6 in. On leaving the ways she was gracefully christened the *Hiroshima Maru* by Miss Thompson, of West Hall, Whitburn, daughter of the senior partner of the firm.

Yung Ping.—On November 13th Messrs. Craig, Taylor & Co. launched from their Thornaby shipbuilding yard, Stockton-on-Tees, a smart passenger and cargo steel screw steamer, built to the order of Messrs. Russell & Co., of Shanghai, New York and London. Her dimensions are as follows:—215 ft. P.P. by 32 ft. by 13 ft. 11½ in. She is to trade in Chinese waters, and is fitted with teak decks and luxurious passenger accommodation. She has water ballast, and is classed in the highest class in Lloyd's, viz., 100 A1. She will have four steam winches by Messrs. R. Rogers & Co., Stockton, patent steam windlass by Messrs. Napier Bros., Limited, Glasgow, and will be fitted with triple-expansion engines by Messrs. Wm. Allan & Co., Scotia Engine Works, Sunderland, with cylinders 15 in., 25 in. and 41 in. by 24 in. stroke, 160 lbs. pressure. The vessel has been built under the superintendence of Messrs. A. & W. Dudgeon, 112, Fenchurch Street, London. As she left the ways she was gracefully christened the *Yung Ping* by Miss Joanna Bogue, youngest daughter of the Rev. John Bogue, of Stockton.

Hercules.—On November 13th a steel schooner-rigged steamer was launched at Falmouth, owned by Companhia Maritier Lottnense de Rehroques E.Salvadge Sociedade Anonyvea de responsabiledade Limitade, Falmouth.

Guernsey.—On November 14th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, which has been built to the order of Mr. Christopher Furness, of West Hartlepool, for Mr. A. N. Hansen, of Copenhagen. The vessel is 324 ft. long over all, 40 ft. 6 in. beam, and 21 ft. 11 in. depth of hold, having a deadweight capacity of 4,350 tons, and will class 100 A1 at Lloyd's. The deck consists of a poop, long raised quarter-deck, long bridges, and topgallant forecastle. The saloon, state room, and captain's and officers' rooms will be aft; the engineer accommodation amidships, and that for the crew in the forecastle. The hull is built with web-frames and double bottom for water ballast under each hold, and a full equipment will be provided, including steam winches, steam steering gear, screw gear aft, patent windlass, patent stockless anchors. The Central Marine Engine Works of W. Gray & Co., Limited, supply the engines, which are of the triple-expansion type of 1,200 H.P., and two large steel boilers to work at a pressure of 160 lbs. per square inch. She was gracefully christened *Guernsey* by Mrs. Hans Nielsen, of Hartlepool.

Natal.—On November 15th an iron ketched-rigged steamer was launched at Beverly; owned by the Hull Steam Fishing and Ice Co., Hull.

T. G. Hutton.—On November 15th Messrs. Short Brothers launched at Pallion a steel screw steamer, built to the order of Mr. T. G. Hutton and partners, of Sunderland. The vessel is of the following dimensions, &c.:—Length, 180ft; breadth, 28ft; depth of hold, 13 ft. 11 in., with a deadweight carrying capacity of about 950 tons. The vessel, which was named the *T. G. Hutton*, is to be fitted with triple-expansion engines of 400 I.H.P.

Amara.—On November 15th the steel screw steamer *Amara*, built to the order of the Persian Gulf Steamship Co., of London, was launched by Messrs. Blumer & Co., at Sunderland. Her dimensions are:—Length, 290 ft.; breadth, 40 ft.; and depth, 25 ft. 5 in.; and she is built under the spar-deck rule to the highest class at Lloyd's. She will have all the latest improvements, including specially-ventilated accommodation, deck-houses, steam steering gear, and electric light throughout, and is intended for the Persian Gulf trade. She is specially adapted for the transport of pilgrims, and is a sister ship to the steamer *Sigris*, recently built by the same firm. The engines, which are of the triple-expansion type, have cylinders 23½ in., 38 in., and 62 in., and 42 in. length of stroke, and large multitubular boilers 11 ft. 9 in. by 15 ft. 6 in., having a total heating surface of 3,800 square feet, and a working pressure of 160 lbs. The machinery and boilers are building by the North-Eastern Marine Engineering Co., of Sunderland. Both hull and engines are being constructed under the superintendence of Messrs. Flannery, Baggallay, & Johnson, of London and Liverpool.

Euthamia.—On November 20th Messrs. A. W. Robinson & Co., engineers and shipbuilders, launched from their Canning Town yard a steam trawler for the North-Eastern Steam Fishing Co., Limited, at Grimsby. The principal dimensions of the vessel are as follows:—Length, 101 ft. 6 in.; breadth, 20 ft. 6 in.; depth, 11 ft. 10 in. The steamer is to be fitted with a steam boiler and compound surface-condensing engine of 45 H.P., and is built to class 100 A at Lloyd's. She was named the *Euthamia*.

Fuping.—On Monday, November 24th, at midday, there was launched a very handsome steel screw passenger steamer, built by the Blyth Shipbuilding Co., Limited, at their shipbuilding and graving dock works at Blyth. The vessel is a sister ship to the *Ching Ping*, which was launched a few weeks ago, and is 223 ft. long. The fittings of this vessel, as in the *Ching Ping*, are very elaborate, and consist of teak decks, teak deck-houses, teak chart and wheel houses, and excellent accommodation is provided for captain and officers and a large number of passengers. The vessel, which was named the *Fuping*, is equipped with all the most recent improvements in deck machinery, including steam windlass and capstan by Napier, Deakin & Nichols, steam steering gear and steam winches for discharging cargo by Messrs. J. Smith & Son, of Newcastle. Triple-expansion engines will be fitted by Mr. M. Pratt, of Huddersfield. The christening ceremony was gracefully performed by Miss Byers, of North Shields, after which the company adjourned to the offices, where the usual toasts were proposed. The *Fuping* has been built to the order of Mr. James Whittall, of London, per Mr. John White, and during construction has been superintended by Mr. J. G. Walton, also of London, who has also looked after the building of the engines. The company's graving dock and repairing department is very busy at present.

LAUNCHES—Scotch.

Martin Saenz.—On October 26th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun the *Martin Saenz*, a steel screw steamer of 3,300 tons, built to the order of a Cadiz firm. Her dimensions are:—Length, 340 ft.; breadth, 42 ft.; depth, 28 ft. The vessel has been built to the highest class at Lloyd's. She has a cellular double bottom right fore and aft, and has been fitted with all the latest appliances for navigation and the rapid loading and discharging of cargo. A handsome clipper bow adds to the general appearance of the ship. Accommodation has been provided for 60 first-class and a large number of second and third-class passengers. Her engines, which are of the triple-expansion type, will be supplied by Messrs. Dunsmuir & Jackson, Govan. As the vessel left the ways she was named by Mrs. Cochrane, wife of the company's superintendent.

Tuskar.—On October 28th an iron screw steamer named the *Tuskar* was launched from the Caledon shipyard of Messrs. W. B. Thompson & Co., Dundee. The *Tuskar*, which is the sixth vessel built in the same shipyard for the Clyde Shipping Co., of Glasgow, is a vessel of about 1,100 tons, is fitted with triple-expansion engines, and is, in every respect, considerably in excess of the Board of Trade and Lloyd's requirements. She is to be engaged in her owners' London and Glasgow trade, and has accommodation for 80 first-class passengers.

Merlin.—On October 28th there was launched from the yard of Messrs. David Macgill & Co., Irvine, the hull of a steamer for the Glasgow and Greenock Shipping Co. Her length is 105 ft.; breadth, 19½ ft.; and depth, 8 ft. 6 in. She was named the *Merlin*, and is to be engined by Messrs. Ross & Duncan, Govan.

David Davies.—On October 29th Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched the powerful steel twin-screw hopper dredger, *David Davies*, capable of raising 1,000 tons per hour from a depth of 35 ft., and having a carrying capacity of 1,000 tons. Her dimensions are 180 ft. by 38 ft. 6 in. by 15 ft. 2 in., and she is propelled by two sets of compound engines to indicate 1,000 H.P. This dredger has been built to the order of the Barry Dock and Railway Co., and is fitted with the builders' patent improved traversing gear, by which the bucket-ladder can be projected in front of the hull, independent of main gearing, thus enabling the vessel at all times to cut her own flotation.

Lismore Castle.—On October 30th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, a steel screw steamer for the Castle Mail Packet Co., Limited, for which Messrs. Donald Currie & Co. are the managing owners. The vessel, which was named the *Lismore Castle*, and is the twelfth built by Barclay, Curle & Co., for Messrs. Currie's African Line, has been built to Lloyd's highest requirements, and to suit the Admiralty's transport service. The following are the principal dimensions:—Length, 400 ft.; breadth, 43·3 ft.; depth, 31 ft.; and she has a tonnage of 4,000 gross. The vessel is intended for the intermediate service between London, Flushing, and South Africa, and has accommodation for about 30 first-class passengers, 40 second, and 80 third, and, if necessary, additional accommodation can be found on the main deck for 400 steerage passengers. She will be propelled by triple-expansion engines, supplied by the builders, which will have all the latest improvements and develop a power of 3,500 horses. She is fitted throughout with the electric light, and will be supplied with refrigerating chamber and engine. The arrangements for loading and discharging cargo are most efficient.

Hinemoa.—On October 30th Messrs. Russell & Co., shipbuilders, Greenock, launched a steel four-masted sailing ship of the following dimensions:—Length, 278 ft.; breadth, 42 ft.; and depth, 24 ft. 3 in.; and of 2,220 tons register, with a deadweight carrying capacity of 3,600 tons. The new vessel (which has been built for Glasgow owners) was named *Hinemoa*.

Pisces and Zodiac.—On October 31st there were launched from the yard of Messrs. Mackie & Thomson, Govan, the *Pisces* and *Zodiac*, steam trawlers, of 150 tons each, built to the order of the Grimsby and North-East Steam Trawling Co. They are each 100 ft. long, 26½ ft. broad, and 11 ft. deep. Engines of 300 I.H.P. will be supplied by Messrs. Muir & Houston, Harbour Engine Works, Glasgow.

Quilpue.—On October 31st Messrs. Russell & Co. launched, at Greenock, a three-masted sailing barque of 2,250 tons deadweight carrying capacity, and of the following dimensions:—Length, 230 ft.; breadth, 36 ft.; and depth, 21 ft. 9 in. The new vessel was named the *Quilpue*. She is built to the order of Messrs. Brodersen, Vaughan & Co., Glasgow.

Swiftsure.—On November 1st Messrs. Stevenson & Asher, Macduff, launched a fishing boat from their yard at the west-end of the harbour. The craft is of the Zulu carvel build, and her dimensions are:—Length of keel, 48 ft.; over stems, 62 ft.; breadth of beam, 17 ft. 8 in.; depth of hold, 8 ft. The boat, which is purchased under the Crofters' Commission Act, is for Mr. Roderick M'Kay, Garrabost, Stornaway. She is fitted up with the improved gearing and accommodation for the prosecution of fishing.

Pyrople.—On November 5th Messrs. Scott & Co., Bowling, near Dumbarton, launched from their building yard the *Pyropie*, a screw steamer of the following dimensions:—Length, 165 ft.; breadth, 26 ft.; depth, 12 ft. 2 in.; built to the order of Mr. William Robertson, 15, Gordon Street, Glasgow, and intended for his general coasting trade. Triple-expansion engines will be supplied by Messrs. Muir & Houston, Glasgow.

Gera.—On November 11th the Fairfield Shipbuilding and Engineering Co., Limited, launched from their yard at Govan the *Gera*, a steel screw steamer of 5,400 tons, built to the order of the Norddeutscher-Lloyd, of Bremen. Her dimensions are:—Length, over all, 430 ft. 10 in.; breadth, moulded, 48 ft.; depth, moulded, 33 ft. The vessel has been constructed in accordance with the latest regulations of the Germanischer Lloyd, under their special survey, and will be classed in the highest grade of that society. The hull is of Siemens-Martin steel. The ship will have accommodation for about 42 first-class, 36 second-class, and 2,100 third-class passengers, besides ample accommodation for officers and crew. The vessel will be lighted throughout by electricity, provided by three engines and dynamos, each furnishing power for 365 incandescent lights. Her engines are of the inverted triple-expansion type, with cylinders 31 in., 52 in., and 83 in. in diameter, and a stroke of 4 ft. 6 in. Steam will be supplied by two double-ended and two single-ended boilers, each of steel plates throughout. The 18 furnaces are also of steel and corrugated. The boilers have been constructed for a working pressure of 150 lbs. per square inch. The *Gera* is similar in every respect to the *Darmstadt*, launched some weeks ago, and is the second of four large steamers the Fairfield Co. are at present constructing for the Norddeutscher-Lloyd. She is coated with Hartmann Rahtjen's composition.

Petropolis.—On November 12th the recently constituted firm of Messrs. Archibald M'Millan & Son, Limited, Dockyard, Dumbarton, launched their first vessel—a finely modelled steel paddle steamer, named the *Petropolis*, and built for foreign owners. The *Petropolis* is 210 ft. long by 23 ft. broad, and 8 ft. 3 in. in depth. The Messrs. M'Millan & Son, Limited, have five other vessels in hand at present.

Galena.—On November 13th a four-masted barque, with iron frame and steel shell, was launched from the yard of Messrs. Alexander Stephen & Sons, at Dundee. The vessel, which was christened the *Galena*, is the largest sailing vessel yet built at the port. The *Galena* is 2,294 tons gross, and her dimensions are:—Length, 292 ft.; breadth, 42 ft; and depth, 22 ft.

Pickhuben.—On November 13th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, the *Pickhuben*, a steel screw steamer of 3,160 tons, built to the order of the Dampfschiffs Rhederei Hansa, of Hamburg. Her dimensions are:—Length, 330 ft.; breadth, 41 ft. 6 in.; depth, 29 ft. 9 in. The vessel is intended for the cargo and cattle trade between Hamburg and Montreal. Triple-expansion engines of 1,500 H.P. will be supplied by the builders. As the vessel left the ways she was named by Mrs. Wolff, wife of the company's ship superintendent.

Mongolian.—On November 13th the already large and well-appointed fleet of Messrs. James & Alex. Allan, Glasgow, received a valuable addition by the launch of a splendid steel screw steamer from David & Wm. Henderson & Co.'s yard at Partick. The vessel, which is 400 ft. long by 45 ft. by 33 ft. 6 in., with a gross tonnage of 4,750 tons, has been built in excess of Lloyd's requirements for their 100 A1 class, on lines which fit her for either the cargo or the passenger trade. For the accommodation of first-class passengers, the fore part of the bridge is fitted up as a handsome dining saloon, tastefully decorated and panelled in solid oak; the upholstery is in fine Utrecht velvet. Off this saloon is a smaller one set apart for the use of ladies. The main saloon is lighted from above by a well through the music saloon. In this deck-house are the captain's and officers' rooms, and the smoking room. Aft the dining saloon are the state rooms. These are of large size, and contain every recognised convenience for the comfort of the passengers. The saloons and state rooms are lit electrically, a complete installation of electric light having been fitted by Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne. The heating is done by means of steam pipes. The crew are berthed forward under the topgallant forecastle, and the engineers in poop deck-house aft. The vessel will have two pole masts, the foremost of steel, but the mainmast will be Oregon pine to enable the carrying of a masthead compass. Muir & Caldwell's combined hand and steam steering gear is fitted in the poop with connections led to the controlling wheel on the bridge. Napier Brothers' steam windlass is in the topgallant forecastle. The vessel has been fitted with every modern improvement for the rapid working of the cargo, making her one of the most completely equipped cargo carriers afloat. The builders will fit her with triple-expansion engines, with cylinders 30 in., 50 in., and 80 in. by 60 in. stroke. The boilers will be fitted with Howden's patent forced draught arrangement. The hull and machinery have been constructed under the personal supervision of Mr. David Johnstone, the superintendent of the Allan Line. On leaving the ways the vessel was named *Mongolian* by Miss Dunlop, Claremont Gardens. A sister vessel is under construction at Meadowside, and will be ready for sea about the spring of next year.

The Marquis.—On November 13th there was launched from the shipbuilding yard of Messrs. John Fullerton & Co., Merksworth, Paisley, an iron screw steamer of 400 tons gross, the third of a fleet of steamers which that firm have launched this year for Messrs. J. & J. Hay, Renfield Street, Glasgow, for their general coasting trade. On leaving the ways the vessel was gracefully christened *The Marquis* by Miss Riddell, Merksworth, Paisley. Engines of the triple-expansion type will be put on board by Messrs. Muir & Houston, Portman Street Engine Works, Glasgow.

Tyne.—On November 15th there was launched from the shipbuilding yard of Messrs. Ramage & Ferguson, Leith, a steel screw steamer of the following dimensions:—Length, keel and fore rake, 177 ft. by 28 ft. by 15 ft. 5 in. depth, moulded, built to the order of the Royal Mail Steam Packet Co., London. The engines, which are also supplied by the builders, are triple-expansion and of the most modern type. The vessel, on leaving the ways, was named the *Tyne* by Mrs. Shelton, Mary Villa, Cherry Bank, Leith.

Port Stanley.—On November 17th Messrs. Russell & Co. launched at Greenock a large steel sailing ship, built to the highest class at Lloyd's, for Messrs. Crawford & Rowatt, Glasgow. The new vessel was named *Port Stanley*. She is of 2,240 tons net register, with a carrying capacity of 3,600 tons deadweight, and her dimensions are as follows:—Length, 280 ft.; breadth, 42 ft.; and depth, 24 ft. 6 in.

Valentia.—On November 22nd there was launched from the Caledon Shipbuilding Yard, Dundee (Messrs. W. B. Thompson & Co., Limited), a small iron screw steamer named the *Valentia* for the coasting trade of the Clyde Shipping Co. in the south of Ireland. The vessel, which has been built of steel, is 29 per cent. in excess of Lloyd's highest class, and has raised quarter-deck bridge and forecastle. Accommodation for animals has also been provided on the main deck and in the fore hold. Her dimensions are—Length, 163 ft. 3 in.; breadth, 27 ft. 6 in.; and depth of hold, 11 ft. 3 in. She is fitted with triple-expansion engines, the cylinders being 14, 22, and 37 in. with a stroke of 30 in. The cabin, hold, engine-room, &c., are lighted with electricity.

Sailing Ship.—On November 24th Messrs. Russell & Co. launched a three-masted steel sailing ship of 1,300 tons net register, for Messrs. J. C. Milne & Co., Aberdeen. After the launch the vessel was towed into Port-Glasgow Harbour to mast and fit out.

Astree.—On November 24th Messrs. Wm. Hamilton & Co. launched a three-masted steel sailing ship named *Astrée*, of 2,060 tons net register, to carry 4,000 tons deadweight cargo. Dimensions—267 ft. 10 in. by 41 ft. 8 in. by 24 ft. 7½ in. The owner is Mr. A. C. Le Quellec, Bordeaux.

Premier.—Messrs. Hawthorns & Co., Leith, have launched a finely-modelled screw steam trawler, built to the order of the Milford Trawlers, and named the *Premier*. She will be fitted by her builders with compound surface-condensing engines, having cylinders 17 in. and 34 in. by 22 in. stroke, working at a boiler pressure of 100 lbs. per square inch, and all the latest improvements. In addition to other two vessels in course of construction by this firm, one of which is to the order of H.M. Government, and intended for coast defence purposes, we understand that the berth now vacated will be taken up by a larger vessel than any yet built by Messrs. Hawthorns.

LAUNCHES—Irish.

Ernesto.—On November 1st there was launched by Messrs. Harland & Wolff, at Belfast, a screw steel steamer named the *Ernesto*, built for Messrs. G. H. Fletcher & Co., Liverpool. Her dimensions are:—Length, 320 ft.; breadth, 39 ft.; while her gross registered tonnage is 2,570. The new vessel will be fitted with triple-expansion engines, and boilers capable of working to 180 lbs. pressure.

Celtic King.—On November 1st there was launched by Messrs. Workman, Clark & Co., Limited, at Belfast, a steel screw steamer, built to the order of Messrs. Wm. Ross & Co., of London, for their Australian trade. The vessel was named the *Celtic King*. The registered dimensions are:—Length, 371·8 ft.; breadth, 44·2 ft.; depth, 27·2 ft.; gross tonnage about 3,510. She will be fitted with two steel boilers, having a working pressure of 160 lbs. per square inch, and engines of the triple-expansion type, with cylinders 26½ in., 44 in. and 72 in. diameter, by 48 in. stroke, capable of indicating 2,000 H.P.

LAUNCH—German.

Schonburg.—On October 18th the Flensburg Shipbuilding Co. launched from their yard a screw steamer of the following dimensions:—270 ft. 9 in. by 37 ft. 2 in. by 17 ft. 3 in., built to the order of the Deutsche Dampfadsiffahrtsge Sellsdsaft Hansa, in Bremen, to class 100 A1 at British Lloyd's. The naming ceremony was performed by Miss Bertha Molzen.

LAUNCH—Danish.

Luneburg.—A steel ice-breaker, built by order of the Prussian Government for use at Harburg, has lately been launched at Steinwarder. She is 62 feet long, and has compound engines indicating 122 H.P. Her name is *Luneburg*.

Mjolner.—This ice breaker, built for the Danish state railways, has lately been launched at the Elsinore ship-building yard. The dimensions of the vessel are:—Length, 135 ft.; width, 33 ft.; depth, 14 ft. 9 in. The *Mjölner* is to carry mails and passengers across the Great Belt during winter. She is provided with three water tanks for sinking her to the right depth when forcing the ice. She is built entirely of steel and fitted with engines of 1,000 H.P. nominal.

TRIAL TRIPS.

Stella.—On October 11th, this composite steam-tug was run at the measured mile near Hartlepool, when a speed of 10½ knots was easily attained. Her particulars are as follows:—Length, between perpendiculars, 80 ft; beam 14 ft.; depth, moulded, 7 ft. 6 in.; engines, 12 in. by 24 in. and 14 in., with steel boiler working at 100 lbs. pressure. She is surveyed by the Board of Trade as a passenger excursion boat. Both boat and machinery are built by F. T. Harker, Stockton-on-Tees, to the order of Capt. Murray, of Middlesborough, who expressed himself highly satisfied with the results of trial trip.

Samos.—On October 15th the fine steel screw steamer *Samos* built by the Flensburg Shipbuilding Co. to the order of the Deutsche Levante Linie, of Hamburg, went on her trial trip in the Flensburg Bay. The vessel is built on the poop-deck type to 1st Div. Veritas. Length, over all, 272 ft.; breadth, 36 ft. 2 in.; depth, 20 ft. 10 in. The engines, 800 H.P., have been built by the Flensburg Shipbuilding Co. on the triple-expansion type. On the trial an average speed of 11¼ knots was run on the measured distance of 18 miles to the entire satisfaction of the owners. This is the third steamer of this description which is built for this company.

Mersey.—On October 17th the ferry steamer *Mersey*, which has been built by Messrs. John Jones & Sons, of Liverpool, for the Woodside Ferry passenger service, went on her official trial trip. On the measured mile the *Mersey* showed a speed of 13 knots an hour. The dimensions of the *Mersey* are:—Length between perpendiculars, 144 ft.; over all, 150 ft.; beam on deck, 32 ft.; on water line, 28 ft.; depth, 10 ft. 5 in.; hold, 10 ft. 9 in. moulded. The *Mersey* is propelled by twin-screw, triple-expansion engines indicating on trial 800 H.P. collectively. She is supplied with two boilers with a working pressure of 160 lbs. per square inch. The *Mersey* and her sister ship, the *Wirral*, will, when loaded, draw only 6 ft. of water. The new steamer accommodates 1,200 passengers.

Innamincka.—On October 25th the official trial trip of the s.s. *Innamincka*, built by Messr. Napier, Shanks & Bell, Yoker, to the order of Messrs. Elder, Smith & Co., London, on behalf of the Adelaide Steamship Co., Port-Adelaide, Australia, took place on the Clyde. The *Innamincka* is a two-deck vessel, with web frames in lieu of lower deck, has cellular double bottom, long full poop, and topgallant forecastle. Her dimensions are 305 ft. by 40 ft. by 22 ft. 8 in.; tonnage, 2,500 tons; class 100 A1 at Lloyd's; schooner rig. Accommodation is provided for about 80 first-class passengers in poop, the staterooms being large and well ventilated, while the fittings are of the most modern description. The dining saloon in deck-house on poop deck is handsomely fitted up, the panelling being of Spanish mahogany, relieved with walnut pilasters and capitals. Beneath the saloon is an auxiliary dining-room, similarly fitted out. The second-class accommodation is in long forecastle and on lower deck forward, fitted up for about 80, the fittings being of a superior description. Spring mattresses and patent lavatories are supplied to each room. The deck gear includes steam windlass, steam steering gear, steam winches and derricks. The vessel is fitted with electric light and electric bells. The *Innamincka* has been designed under the superintendence of Capt. Joseph Hay, for the service between Adelaide, South Australia, and Melbourne and Sydney, and will prove a valuable addition to the present fleet. The engines of the vessel are from the works of Messrs. Bow, M'Lachlan & Co., Paisley, and worked with perfect smoothness at a piston speed of 750 ft. per minute, the valve gear being Morton's patent. On trial on the measured mile a mean speed of over 14¾ knots was attained.

Beechdene.—On October 25th the new steamer *Beechdene*, lately launched from the shipbuilding yard of Messrs. Short Brothers, and built to the order of Messrs. J. T. Lunn & Co., of Newcastle-on-Tyne, went out on a trial trip, and after adjusting the compasses was run over the measured mile, when 11 knots was obtained, the engines working with perfect smoothness. The trial was in every way satisfactory. The vessel is built of steel, and her engines, which are of 200 N.H.P., are on the quadruple-expansion principle.

Herman Wedel Jarlsberg.—On October 25th the large steel screw steamer *Herman Wedel Jarlsberg*, built by Messrs. Wm. Gray & Co., Limited, to the order of Messrs. J. Christensen & Co., of Bergen, Norway, went on her trial trip. The vessel takes Lloyd's highest class, and is of the following dimensions: Length, over all, 336 ft.; breadth, 41 ft. 6 in.; depth, 24 ft.; and her deadweight capacity is over 4,500 tons. The engines, which developed on the trial 1,500 H.P., are of the triple-expansion type, working on three cranks, and are supplied by the Central Marine Engine Works. The cylinders are 24 in., 38 in., and 64 in. diameter, and the stroke of all the pistons is 42 in. Steam is supplied by two large steel boilers, working at a pressure of 160 lbs. per square inch. With the bunker, coals and ballast, the vessel had on board on the morning of the trial 1,300 tons deadweight. After adjusting compasses the engines were opened out full speed ahead, when it was found on an hour's run that the vessel had made a speed of over 12 knots per hour, the engines running with perfectly satisfactory smoothness and regularity at a speed of 83 to 85 revolutions per minute. There was no water applied to any bearing whatever throughout the trial, neither was any part found to be heated at all, and the absence of all knock or other unpleasant sound, the stiffness of the framework of the engine and the freedom of motion of the working parts formed matter of general comment amongst the numerous visitors who were on board. We should mention that the owners were represented by Captain Klaus Reimers, who has superintended the building of the ship, and Mr. B. Concheron, the superintending engineer, the builders and engineers being represented by Mr. G. H. Baines and Mr. T. Mudd. After the more serious duties of the speed trial were completed the party adjourned to the neat little saloon to partake of an excellent luncheon, at which toasts of success to the ship and her owners, and to the shipbuilders and engineers, were duly honoured, the owners' representatives expressing in the most cordial terms their great satisfaction at the rapidity with which the vessel had been built, and at the character and performance of the same and her machinery when completed.

Mayumba.—On October 28th the steel screw steamer *Mayumba* proceeded from the Tees on her trial trip. This vessel has been built by Messrs. Sir Raylton Dixon & Co., Middlesbro', for Messrs. Elder, Dempster & Co., Liverpool, and is of the following dimensions:—Length, over all, 307 ft.; breadth, 40 ft.; depth, moulded, 21 ft. 4 in., with a carrying capacity of about 3,600 tons. She has been built on the web-frame principle, with long raised quarter-deck and partial awning-deck, and having wood-sheathed decks. Accommodation for officers and men above deck, in well-ventilated houses, for the West African trade. Her machinery has been fitted by Messrs. T. Richardson & Sons, Hartlepool, having cylinders 22½ in., 37 in., and 61 in. by 39 in. stroke. This is the nineteenth vessel delivered by Messrs. Sir Raylton Dixon & Co. this year, only one of which has been under 3,000 tons.

Oxfordness.—On November 1st this vessel left the Tees for r trial trip. Her dimensions are:—270 ft. by 37 ft. by 18 ft., t by Messrs. Richard Dnck & Co., Stockton, for Messrs. ar, Groves & Co., London. Her engines are of the triple-expansion type, of 150 N.H.P., having cylinders 21 in., 34 in., and 56 in. in diameter, by 36 in. stroke, and working at 160 lbs pressure. They were built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working satisfactorily, and attained a speed of 10 knots.

Citta di Venezia.—On November 3rd the trial trip took place of the large steel screw steamer *Citta di Venezia*, built for Messrs. Laverello Bros., Genoa, by Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne. After adjusting compasses and making a series of progressive speed runs over the measured mile, a full speed trial run was made from Tynemouth Castle to Newbiggin and back, with the most entirely satisfactory results, the machinery working splendidly, and the vessel making an average speed from Tynemouth to Newbiggin and back of 14·6 knots per hour, which was considerably in excess of the speed guaranteed by the builders. The representatives of the owners having expressed their entire satisfaction with the trial trip, the vessel returned to the Tyne, and sailed in a few days for Genoa, to receive her passengers, and then proceeded to the River Plate, in Messrs. Laverello Brothers' South American line, for which she has been specially designed and built. The general dimensions of the steamer are:—Length, 390 ft., over all; breadth, 44 ft.; depth, moulded, 28 ft. The engines, which have been constructed by the Wallsend Slipway and Engineering Co., have cylinders 30 in., 50 in., 79 in. diameter, by 54 in. stroke, and are capable of indicating 3,300 H.P. The steamer will carry about 2,000 passengers in all.

Amra.—On November 3rd the British India Co's steamer *Amra*, built by the Ailsa Shipbuilding Co., Troon, was engined by Dunsmuir & Jackson, Govan, ran her official trial between the Cloch and Cumbrae lights, when a mean speed of 12·8 knots was attained, being nearly a knot in excess of contract speed, notwithstanding that the weather was stormy. Her dimensions are 190 ft. by 29 ft. by 20 ft.; and she has triple-expansion engines, 16 in., 26 in., and 42 in. cylinders, by 30 in. stroke, and is fitted with Howden's patent forced draught. Electric light, fitted by Messrs. Harvie & Co., of Glasgow, is used throughout the ship. The engines worked without a hitch, and the forced draught system worked satisfactorily, there being an ample supply of steam. The *Amra* is the eighth steamer the Ailsa Shipbuilding Co. have built for the British India Co., and she is intended for their passenger trade on the Indian coast. At the trial there was a numerous company of ladies and gentlemen, amongst the latter being:—Messrs. Alex. McCreadie and P. Wallace, of the Ailsa Co.; Mr. Clark, superintendent to the British India Co.; Mr. Jackson, of Messrs. Dunsmuir and Jackson; Mr. James Wyllie, shipowner, Troon; Mr. Eben Wallace, Messrs. Wyllie's marine superintendent; Mr. David Pollock, consulting engineer, Hope Street, Glasgow, &c.

Marston Moor.—On November 3rd this screw steamer, built for the South Shields Steam Shipping Co. by Messrs. John Redhead & Sons, South Shields, was taken to sea for her trial trip. The trial gave complete satisfaction, a speed of 11 knots an hour being attained.

Salatiga.—On November 5th the trial took place of the steel screw steamer *Salatiga*, built at the Walker yard of Messrs. Sir W. G. Armstrong, Mitchell & Co. for the Deutsche Dampfschiffs Rhederei, for their passenger and goods trade between Hamburg and Java. Several runs were made on the measured mile off Whitley, when a speed of about 12 knots was maintained, the engines and boilers working very satisfactorily. The vessel has been built to class 100 A1 at Lloyd's, and is of the following dimensions:—Length, 300 ft.; beam, 41 ft.; depth, moulded, 24 ft. 1 in.; and is capable of carrying 3,200 tons deadweight. During the afternoon the *Salatiga* sailed for Hamburg, where her joiner work will be completed.

Franklin.—On Thursday, November 6th, the s.s. *Franklin*, a steel screw steamer, built by Messrs. Sir Raylton Dixon & Co., Middlesbro', proceeded from the Tees on her trial trip. This vessel, which has been built for Messrs. Arthur Holland & Co., London, is constructed on the web-frame principle, with poop, raised quarter-deck, and top-gallant forecastle. Her leading dimensions being:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in.; carrying capacity about 3,300 tons. Her engines have been fitted by the North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 21 in., 35 in. by 39 in. stroke, and they gave every satisfaction on trial.

Doune Castle.—On November 8th the new Castle Line intermediate steamship *Doune Castle*, which has been built for Messrs. Donald Currie & Co. by Messrs. Barclay, Curle & Co., went on her trial trip down the Clyde. She ran twice between the Cloch and Cumbrae Lights, and maintained a mean speed of 13¾ knots per hour. The trial was in every way satisfactory, and the vessel proceeded to London to take up her station. The *Doune Castle* is 4,045 tons, and will carry 5,000 tons. She has accommodation for first, second, and third-class passengers and will leave London for South Africa, viâ Flushing, on the 26th inst.

Feronia.—On November 11th this vessel left the Tees for her trial trip. Her dimensions are 315 ft. by 40 ft. 6 in. by 22 ft. 6 in., built by Messrs. Ropner & Sons, Stockton, for Messrs. Gladstone & Cornforth, West Hartlepool. Her engines are of the triple-expansion type, of 210 N.H.P., having cylinders 23 in., 38 in. and 62½ in. in diameter, by 42 in. stroke, working at 160 lbs. pressure, and have been built by Messrs. Blair & Co., Stockton. She made a most successful run, everything working satisfactorily.

Pentakota.—On November 21st the *Pentakota*, 3,500 tons, launched in September last, by Messrs. A. & J. Inglis, Pointhouse, for the British India Steam Navigation Co., was officially tried at Skelmorlie on the Clyde, when the speed of 13¼ knots was maintained. The measured mile was run 10 times in all, the machinery working in the most perfect manner throughout. Capt. Hodgkinson, R.N., and Mr. John Clark, engineer superintendent, observed the trials on behalf of the company. After dinner the usual complimentary speeches were made, and in the evening the *Pentakota* entered the James Watt Dock, Greenock, to complete her loading for India. She is the sixth vessel of the type built at Pointhouse for the British India Co.

Sterling.—On November 22nd the screw-steamer *Sterling*, lately built by S. & H. Morton & Co., Leith, for the Ostlandske Lloyd Co., Christiania, went on a trial trip on the Firth of Forth, when a speed of 12 knots an hour was obtained, which was considered highly satisfactory.

Tekoa.—This vessel is a sister ship to the *Rangatira*, which went to sea about three months ago, and, it will be remembered, was described as being by far the largest vessel that had ever been built in the port of the Hartlepools. The s.s. *Tekoa* has been built by Messrs. Wm. Gray & Co., Limited, to the order of Mr. Christopher Furness, for the New Zealand Steamship Co., Limited, of London. The vessel takes Lloyd's highest class, and her dimensions are:—Length, over all, 376 ft. 6 in.; breadth, 47 ft.; depth, 29 ft. 4 in., with a carrying capacity of about 6,250 tons. The main engines for driving the vessel have been supplied by the Central Marine Engine Works, of Messrs. Wm. Gray & Co, Limited, and are of the triple-expansion type, working on three cranks. The cylinders are 27 in., 43 in., and 72 in. in diameter, with a piston stroke of 45 in. Steam is supplied by three very large double-ended boilers, containing in all 12 furnaces, all of which lead into one great funnel 10 ft. in diameter. The working pressure of the steam is 160 lbs. per square inch. The engine-room is replete with every modern appliance, and is arranged throughout in the most convenient manner. The vessel being intended for the New Zealand Shipping Co.'s line of steamers for carrying frozen meat to this country, has been fitted with two complete sets of refrigerating machinery, the holds being lined all over with a non-conducting material, so as to entirely insulate them from the ordinary atmosphere. The vessel proceeded to sea at about 6 a.m., November 18th, having on board Mr. Johnson, one of the directors, Mrs. Johnson, Mrs. Captain Stuart, and other lady friends. Mr. A. Campbell, superintendent engineer for the New Zealand Shipping Co., was also on board, and Mr. Mudd, representing the engine builders. The vessel is under the command of Captain Stuart, and the engine-room in charge of Mr. Parsons, chief engineer. After the vessel had been manœuvred for awhile to enable Mr Baird, Sir Wm. Thomson's compass adjuster, and Mr Berry to adjust the compasses, the engines were put full speed ahead, when it was found the average speed, taken over a two hours' run was 12¼ knots per hour, the vessel having on board 2,000 tons deadweight. Everything continued to work in a perfectly satisfactory manner, the bearings keeping quite cool without the application of water, and the engines running so quietly as not to be heard on deck. Immediately the trial was over and the passengers had been transferred to a tug, the vessel proceeded to London, where she loads for New Zealand.

Isabel.—The ocean-going steel steam-tug *Isabel*, built and engined by Messrs. Vosper & Co., of Portsmouth, for Messrs. Watkins & Co., of London, recently accomplished her steam trial trip in a very satisfactory way in every respect on the Government measured mile in Stokes Bay, when steam was easily maintained at 160 lbs. pressure, with a vacuum of 27 in., and she attained a speed of 11¼ knots, her engines indicating 380 H.P. She measures 86 ft. 8 in. long, 17 ft. 6 in. beam, and 9 ft. 8 in. deep. She has large bunker capacity, is fitted with bridge, and has all the latest improvements. Her engines are of the triple-expansion type, the diameters of the cylinders being 12½ in., 19 in, and 32 in., and length of stroke 21 in.

Taranaca.—The new twin-screw steamer *Taranaca*, built by Messrs. Mnrdoch & Murray, Port-Glasgow, for trading on the river Amazon, went on her trial trip on the river Clyde. The vessel is 130 ft. by 25 ft. by 9 ft. deep, is sponsoned on each side to a width of 30 ft. She is fitted with two independent sets of triple-expansion engines by William Kemp, Glasgow, with cylinders 8 in., 12½ in. and 20 in. diameter by 18 in. stroke, with a boiler 11 ft. in diameter and 10 ft. long, suitable for a working pressure of 175 lb. per square inch. The vessel was loaded with 130 tons of coal, and on a mean draught of 6 ft. 2 in. on the measured mile a mean speed of 9 knots was obtained.

OBITUARY.

We regret to have to announce the death of Mr. Bernard Waymouth, secretary to Lloyd's Register of British and Foreign Shipping, which took place suddenly on November 25th, at the offices of the Registry, 2, White Lion Court, Cornhill, E.C. Mr. Waymouth, who was 66 years of age, had been ailing for some time, but was still attending to his duties. He had been in the service of Lloyd's Register since 1854, for the last 17 years as secretary, an office which he filled with conspicuous ability. He was highly respected and much appreciated by all those interested in the Mercantile Marine of the country. Mr. Waymonth was appointed a member of more than one Royal Commission on shipping matters, and was a vice-president of the Institute of Naval Architects.

Reviews.

Screw Threads, and Methods of Producing them. By Paul N. Haslnck. London: Crosby Lockwood & Son. 1890.

This is a pocket-book actually, for the size will permit of its going even into a waistcoat pocket. The subject being one upon which information is continually wanted in a workshop, it is therefore eminently suitable for foremen and all those who have to cut threads, either by taps and stocks and dies or in a lathe. In this case, unlike a drawing office, there is nowhere to put away a book except in the clothes. The author, therefore, in arriving at this, his third addition, and increasing the matter, has still kept it small, and rightly so. In the small space at disposal, however, over 70 illustrations have been got in, commencing with the theory of screws, gauges for testing, and the forms in use in different countries, and going on to stocks and dies, trains of wheels for screw-cutting in a lathe, the tools used for doing so, and ending with taps generally. Everything is of a thoroughly practical character, as it should be. Perhaps the fourth and fifth chapters are most fully treated, screw-cutting being where a workman finds most difficulty. After digesting what is presented here thoroughly, we should not think the most dull comprehension would go empty away. Arrangements are shown for ganging the angles of the tools and threads, and how to set the cutter when inside work is required. We also find complex rates completely studied, while hand-chasing is not omitted. In the tables to finish up with are Whitworth's standard threads, Holzapfel's, the Swiss small screw gauge, the American and French standards, and Whitworth's for gas pipes, hexagon nuts and taps. We can well recommend the little book to all concerned in the cutting of screws in any form.

Tables and Memoranda for Electrical Engineers, and *Practical Dynamo Building for Amateurs.* By F. Walker. London: Iliffe & Son.

The first of these is in pocket-book form, and opens with tables of the different wire gauge measurements. Formulæ relating to motors and dynamometers are then found, as also tables of the various types of accumulators and electrical horse-powers in terms of electromotive force and current. Then follows some particulars of the winding of bobbins, resistance of armatures, Board of Trade units, estimation of lamp-power, and measurement of resistance.

The second work is of a more pretentious character, and contains over 60 pages of closely printed matter, and some good illustrations. In the introduction it is presumed that with the number of amateurs there are many who would like to construct a dynamo, and these pages are for instruction to that end. Figured dimensions are found under the heading, field magnets, the same with armature core. The directions are simple as regards winding. We may say the same respecting the chapter on commutators. Working sketches are again found under the heading, brush-holder. The other articles treated comprise terminals, winding the field, secondary batteries, electroplating arc-lamps and leads. Of the two, perhaps the latter effort is more worthy of commendation. Though only intended for amateurs to design a model from, yet anyone not far advanced in this branch of engineering may find a few useful wrinkles to help him.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

"THE HOLMES TORPEDO FINDER."

To the Editor of The Marine Engineer.

Sir,—My attention having been drawn to a letter signed "Manwell & Glen" in your October issue regarding the Holmes Torpedo Finder, and that no credit is due to Mr. Joseph R. Holmes, of the Holmes Lights Co., Limited. I have to state that the service has to thank Mr. Joseph R. Holmes for this invention in August, 1876, when Mr. Holmes was a guest of mine on board H.M.S. *Asia*, and after a visit to H.M.S. *Vernon*, he communicated to me his project of the Finder, and next day left for London, when Mr. N. J. Holmes (at his own request) preferred the management of the Admiralty negotiations, as his son, Mr. Joseph R. Holmes, was otherwise engaged.

I am, Sir, yours truly,
H. T. Clanchy, Captain R.N., Retired.
Croom, Co. Limerick, 24th Nov., 1890.

RUSSIAN IMPERIAL YACHT, "POLAR STAR."

To the Editor of The Marine Engineer.

Dear Sir,—I have just noticed in the current number of the Marine Engineer, a paragraph on the new Russian imperial yacht, *Polar Star*, which is so utterly misleading in all particulars that, in justice to our friends in Russia, who are doing such excellent work, both in marine engineering and shipbuilding, I cannot refrain from replying. I am confident you will gladly correct any erroneous information which has been sent to you.

I am at present on a visit to St. Petersburg, and have been on board the *Polar Star*, both times she has been under steam. I am thus fully acquainted with all the facts, and can state them accurately.

Far from the steam trials being unsatisfactory, they are so excellent as to make the performance of this yacht noteworthy in the history of shipbuilding.

Long ere the *Polar Star* was ready to be tried it was determined, after careful examination of the performance of previous ships, to get ready a new set of propeller blades, which would increase the diameter of the propellers from 14 ft. 6 in. to 16 ft. This was done, and the new blades have been ready for months.

Before the vessel went into dry dock at Cronstadt, to have the state of her bottom examined, there was a preliminary run of a few hours to see that everything was right about the engines and ship. No attempt was made on this trial to get full speed. Everything was found in first-class order, and if it had been desired, the 14½ knots, noted in the report sent you, could have been far surpassed.

A few days after there was a second trial, with the new propellers, on which an average speed of 18·85 knots was got over a four knot course, and the last of the four knots gave 19 knots per hour. This was done without any forcing whatever. In the engine-room there was no such trained staff as any of our large yards at home could furnish; the stokers were ordinary sailors, few of whom had had any previous training; and the coal would certainly not have been considered proper trial trip coal in Britain. More than this, before the end of the trial, a gauge-glass in one of the boilers having broken, that boiler was dispensed with for the rest of the day, and the highest results were got with nine boilers out of ten on NO FORCED DRAUGHT. As during the whole day the engines were not nearly at their fullest expansion, the above results can be improved upon at any time, with reasonable weather.

The yacht promises to be an exceedingly comfortable ship, as at 19 knots the engines were working easily and almost noiselessly, and better still, there was an entire absence of vibration at the stern.

The following particulars will be of interest:—

Length of ship	314 ft. 0 in.
Breadth	46 ft. 0 in.
Depth	17 ft. 3 in.
Displacement on trial	3,450 tons.
H.P. at 18·85 knots	5,602

This, I may note, is a large improvement on the best results got from H.M.S. *Iris*, and reflects very great credit on the designers here. I can also testify to the high-class manner in which the whole machinery was manufactured and constructed. The fact that the results attained have been got without a hitch from the commencement, and on the first attempt to get good results, speak for themselves.

The yacht is now being furnished at St. Petersburg. The whole of the internal fittings are comparatively plain, but in good taste. The wood work, which is from the commoner woods of Russia, by special request of the Emperor, is an excellent example of the high-class work for which the Russian wood-workers are, or ought to be, famous.

After finishing, the *Polar Star* will proceed to sea, and will visit England near the end of this year. She will, no doubt, create a similar interest to that caused in naval circles by the Russian man-of-war *Pamyat Azova*, which was also constructed and fitted with machinery at the Baltic Works, St. Petersburg. This vessel called at Plymouth lately, and aroused the surprise of our countrymen; a surprise which in some cases amounted to scepticism that she could have been built in Russia.

I am, Sir,
Yours truly,
John H. Macalpine.

St. Petersburg,
Nov. 6th, 1890.

KNAPSACK DIVING APPARATUS.

To the Editor of The Marine Engineer.

Sir,—Some time ago when reading the account of the accident to the *City of Paris*, and consequently the certain amount of peril in which the people on board were placed, through the flooding of both engine-rooms, it occurred to me that a great deal of danger might have been avoided if the vessel had carried a "Knapsack Diving Apparatus," with someone capable of using it. Had such an apparatus been on board, the carpenter could have made a number of wooden tapered plugs. With a hammer and those plugs the diver could have filled the holes in the rose plate on the ship's side. It would have then been a matter of a few hours to clear the engine-rooms of water. The pressure of water would keep the plugs tight. The small extra cost, the apparatus, and a man, or men, to use it (say the bo'sen and his men), would be nothing compared with the factor of safety that the ship would acquire. As you are no doubt aware, a diving apparatus is carried on most of our men-of-war vessels, the ship I am in having once had the use of the *Pheaton's*

Diver. They might as easily be carried on large passenger ships, as on navy vessels.

Should you think the suggestion of any use, perhaps you will publish it.

I remain,
Malta, November 10th, 1890. Yours, &c.,
J. M. N.

Miscellaneous.

The Largest Steam Yacht in the World.—For a Russian millionaire, M. Kousnezoff, Mr. G. L. Watson, of Glasgow, has been commissioned to design a steam yacht of 1,000 tons, said to be the largest private yacht ever built. The vessel is to be constructed by Messrs. Scott & Co., of Greenock, and some of her dimensions will be:—Length between perpendiculars, 240 ft. moulded; breadth, 30 ft. 6 in.; depth, 20 ft. 6 in. Messrs. Scott & Co. will also make the machinery, which is to be designed to drive the yacht at a speed of about 15 knots an hour.

Marine Engineers' Union.—The third anniversary of the South Shields branch of the Marine Engineers' Union was held on November 18th, in the Marine Engineers' Hall, King Street, South Shields. Mr. W. H. Thorn, who presided, stated that the present membership of the union was 7,669, and during the past year 3,114 members had been enrolled. During the same period the South Shields branch had enrolled an average of 50 members per month. Financially, as well as numerically, the union was progressing, and there was at present a balance at the bank of £1,700.

The Spanish Navy.—A decree published in the Spanish official *Gazette*, embodies the policy of Admiral Beranger, Minister of Marine, for the reconstruction of the Spanish Navy on a practical basis, and some details are cabled by the Madrid correspondent of the *Times*. The minister, whose advanced ideas on naval construction are well known, quotes freely in his preamble from the best known foreign naval authorities of the day, and points out that it is most essential for Spain, under her special conditions, financial and otherwise, to have, first, rapid steaming cruisers instead of more costly heavy armour-clads; secondly, lighter armament and greater uniformity; and, thirdly, interior armouring and protection as against outside armour belts. In support of this he specially quotes Admiral Mayne, Lord Brassey, and Sir N. Barnaby. The decree provides that for the future cruisers, both of the first and second class, shall have a minimum speed of 20 knots under natural draught. The minister is opposed to forced draught. In view of the fact that Spain possesses no fortified coaling stations, he proposes that the new vessels shall carry sufficient coal to enable them to steam from 12,000 to 15,000 miles. Admiral Beranger is also in favour of torpedo boats for harbour defence, and is of opinion that their numbers should be largely increased. While recognising the difficulty of carrying out his scheme, in consequence of the unfortunate condition of the Spanish Treasury, which renders impossible the same rapid advancement in naval construction that is made by other nations, he points out the absolute necessity of at once placing the Spanish Navy on a sounder footing, and one more consistent with the position of the country as a naval power.

New Steamers for the German Transatlantic Trade.—The Hamburg-American Packet Co. have contracted for two new steamers for the North American cargo and 'tween deck passenger trade. One will be built at the Reiherstieg Shipbuilding Co.'s yard, and the other at Messrs. Blohm & Voss's, Hamburg. They will each be 320 ft. long, and have a speed of 11½ knots.

New Sea Sounding Apparatus.—On the 20th November an interesting trial of a Sea Sounding Apparatus took place on the Firth of Clyde and Loch Long. The yacht *Snark* having been fitted with the machine, left the jetty at Craigendoran with a party of gentlemen representing several of the great steamship companies. Many soundings were taken during the day, in depth varying from 7 to 60 fathoms, the vessel going full speed and also stopped. The soundings were verified by the nautical gentlemen on board, by means of the chart, in the usual way, and found correct. The great convenience of the machine for rapid working, its accuracy, and simplicity, and the many ingenious points of detail in almost every part of it, were warmly praised by all present. At a luncheon on board, Mr. Archibald Denny proposed the success of the patentees, Messrs. Cooper and Wignell, and after other courtesies, the party landed at Craigendoran.

Herreshoff, the Blind Shipbuilder.—One of the most notable of the world's blind workers is John B. Herreshoff, who lives at Bristol, R.I., and is at the head of one of the largest shipbuilding firms in the United States. He has been blind since his fifteenth year, but he has designed and superintended the construction of some of the finest steam yachts now afloat. Not since he was a boy has he been able to see the graceful outlines of the ships and schooners which plough the blue waters in sight of which he was born, but he carries a perfect picture of each and every one of them in his memory. So completely is he the master, even of the smallest details of his vast business, that when a representative of the South-American called upon him a few years ago, and asked for what sum he could build and deliver three torpedo boats of a peculiar size and pattern, he requested only half an hour's time for deliberation before giving his answer. Before the half-hour was up he had mentally gone over the whole matter, cost of building and the time that would be required, working from the new and strange plans submitted, and he had decided at what price he would be justified in taking the contract. His offer was accepted, the boats were built and delivered at the time stipulated, and Herreshoff Brothers made a handsome profit from the contract.

Forced Draught Trials.—After the completion of experiments with Mr. Martin's system of induced draught at Portsmouth upon one of the discarded locomotive boilers of the *Polyphemus*, which lasted from the 25th of July until the 9th of August last, it was determined for purposes of comparison to carry out a series of similar trials upon the same boiler with forced draught. These experiments have just been concluded. The only mishap that occurred was the temporary breakdown of the large fan which supplied the air from outside the boiler room. The naval authorities decline to furnish the results of the several trials for comparison with the data already published in the Marine Engineer, September number. It is, however, understood that, while the boiler tubes passed successfully through both ordeals, the steaming with induced draught gave superior evaporation per pound of coal and square foot of heating surface. Engineers find it difficult to explain how a type of boiler which failed utterly in the *Polyphemus* should not only have passed successfully through these exceptional endurance trials, but have proved its superiority to the pattern at present fitted in Her Majesty's ships. Since its removal from the ram the boiler was made to take its feed through convolutions at the top, by which the water was warmed, instead of being received at the bottom, whereby chills were produced. This and better stoking probably prevented leakage.

Important Shipbuilding Orders.—Mr. Bryce-Douglas, managing director of the Naval Construction and Armaments Co., has returned from America, and reports that he has secured the subsidy from the Dominion Government for a fast Atlantic line, which will require four large twin-screw steamers, whose speed will not be less than 20 knots. The scheme also embraces a line of fast steamers between Vancouver and the Australian colonies, touching at the Sandwich and the Fiji Islands, for which a separate subsidy has been voted by the Canadian Parliament, and negotiations are now pending with the Australian Government for their quota of the subsidy, which will, no doubt, be forthcoming, as the time to Australia will be reduced by the Canadian route by about three days. It is proposed that the steamers shall land at Brisbane as the nearest port, and from this point the line will be connected with the Australian railway systems. The Naval Construction and Armaments Co. have received an order from Messrs. James Little & Co., Glasgow and Barrow, for building a steamer of 3,300 tons, which will be engined by Messrs. Westray & Copeland, Barrow.

The Pulsometer Engineering Company, Limited, are very busy with their patent machinery for filtering river or canal water, having now in hand orders for plants equal to 2,400,000 gallons of muddy water per 24 hours. These filters are used on river steamers, and ocean liners when in dock, for filling boilers with clean water before starting.

Contract for Engines.—Although the blocks for the laying down at Portsmouth of the new first-class protected cruiser *Crescent*, 7,700 tons displacement, are not yet placed in position, a contract for the building of her engines has already been concluded with Messrs. John Penn & Sons, of Greenwich. The engines are to develop 12,000 horses with forced draught and 10,000 with natural draught.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from October 16th to November 15th, 1890.

16281	A. G. Mumford and Anthony. Steam-engines or pumps.
16323	W. P. Thompson. Packings for manholes, doors, tubes and cylinders (Gustav Adolph, Germany).
16354	A. M. Clark. Screw propellers (Hermann Thomas, U.S.)
16365	J. Taylor. Ships propelled by twin screws.
16385	A. B. Brown. Stuffing-boxes for pistons or other rods.
16393	J. Gifford and R. Richardson. Steering and stopping of steamships.
16419	J. N. Paxman. Multitubular steam generators.
16551	J. J. Smith and T. F. Horen. Buoyant propeller.
16662	J. Hilton, E. Jackson and G. C. Hilton. Steam boiler and other furnaces.
16669	T. Read. Boilers.
16686	F. G. Fowler. Steam boilers.
16693	E. Edwards. Steam boilers (C. M. Schmidt, Germany).
16775	F. G. Bates. Furnaces for steam boilers.
16776	H C. Paterson. Furnaces for heating steam boilers.
16925	J. Murrie. Steam traps.
16997	W. H. Taylor. Apparatus for shutting off the supply of steam from marine or other boilers (J. W. Haigh, at present on the high seas).
17033	Juan Anglés Y. Gibert. Propelling vessels.
17091	E. G. Urry and Guillermo Antonio Farini. Steam generators.
17209	J. Scott. Steam boilers.
17301	A. F. Mabon. Engine indicators.
17447	J. Klin. Expansion slide valve motion for compound steam-engines.
17562	J. Dougherty. Condensers for steam-engines.
17566	R. McGlasson. Screw propellers.
17655	E. Bairstow. Steam boilers.
17656	J. Ezra Sykes. Patent rose boxes for pump suction pipes.
17657	J. Kershaw Hill. Valves for pumps and other purposes.
17673	W. Fairweather. Sectional steam boilers (Nathaniel W. Pratt and the Badcock & Wilcox Co., U.S.)
17695	C. Vallet. Steam-engines.
17696	G. A. Dick. Marine propulsion.
17751	J. Dunnachie. Steam boiler and other furnaces.
17786	Nesbitt Breillat Heffernan. Propulsion of vessels.
17809	J. I. Thornycroft. Steam generators.
17818	A. Vogetsang. Wheels for propelling vessels.
17826	E. G. Constantine. Low water alarms for steam boilers.
17830	A. Beldam. Steam generators.
17842	G. Booth and G. Pickersgill. Flanging land and marine boiler flues upon the "Adamson" principle.
17844	J. F. Rankin and M. Rankin. Steam boiler furnaces.
17848	A. S. Gore. Controlling the speed of marine and other steam-engines.
17851	H. Binko. Electric thermostats.
17856	T. Mudd. Furnace flues for marine and other boilers.
18090	A. J. Boult. Cut-offs for steam-engines (George Fussell, U.S.).
18110	T. Ledward. Steam boilers.
18172	W. H. Hollins. Steam boiler {furnaces to prevent smoke.
18318	H. W. Morley. Steam and other fluid pressure engines.
18320	C. A. Fnge. Boiler tubes for preventing corrosion and incrustation.
18326	D. B. Morison. Water gauges for steam boilers.
18364	A. A. Rickaby. Steam engines fitted with "jet" condensers.
18451	J. L. Wade. Preventing and removing incrustation in steam boilers.
18464	W. H. Temple. Boiler furnaces.

At the examination held in Glasgow last month, Mr. R. W. Jack, of Renfrew, Scotland, passed as Extra-chief Engineer. He attended Messrs. MacDonald & Morrison's classes at 16, Bridge Street, Glasgow, who have, we understand, at present a number of students for the higher certificates, as well as Board of Trade and Lloyd's surveyorships.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

EXTRA FIRST CLASS.

October 25th, 1890.	Duncannon, F.	Extra 1C	London
" " "	Lloyd, G. C.	" "	Leith
" " "	Murdoch, Geo.	" "	"
" " "	Pearison, Jas.	" "	London
November 1st "	Hulse, Chas. E.......	" "	"
" " "	Jack, Richard W, ...	" "	Glasgow

October 25th, 1890.

Anderson, Alex.	2C	Glasgow
Anderson, John	1C	"
Barton, Frank S.	2C	L'pool
Campbell, Wm.	1C	Glasgow
Davies, David L.	2C	Cardiff
Dewar, J. Mckie	2C	Glasgow
Forster, John A.	1C	N.Shields
Fraser, Geo. B.	1C	Glasgow
Gibbs, James G.	2C	Cardiff
Glacken, Geo.	2C	N.Shields
Harris, Robert P.	2C	"
Hughes, John ..	2C	Glasgow
Inman, G. M. S.	1C	L'pool
Kingsbury, L. B.	1C	London
Marsack, Wm. A.	2C	"
Matheson, — ..	2C	Glasgow
McDermit, John	2C	W.Hrtpl
McGill, Wm. ..	1C	Glasgow
McGregor, J. H.	2C	Cardiff
Mooper, Geo. H.	2C	W.Hrtpl
Morley, M. P.	2C	Cork
Murray, Wm. G.	2C	Glasgow
Nutt, Edwin ..	2C	London
Peden, George	1C	Glasgow
Pickering, Rees	2C	Cardiff
Pugsley, James	1C	"
Redman, Charles	1C	"
Res, Geo. D. ..	2C	W. Hrtpl
Samuel, W. E.	1C	Cardiff
Scurr, Albert E	2C	W. Hrtpl
Simpson, A. E.	1C	"
Stevenson, Robt.	2C	L'pool
Sturgeon, F. L.	1C	London
Thomas, Wm. L.	1C	Cardiff
Thomson, John	2C	London
Tose, Matthew	2C	W. Hrtpl
Wall, Joshua ..	1C	Cardiff
Welsh, David B.	2C	London
Whiteside, H...	2C	N.Shields
Wilson, Wm. ..	2C	L'pool
Whyte, E. Jno.	2C	Hull
Widdowfield, J.	1C	N.Shields
Winter, Jos. W.	1C	London
Wokes, Chas. ..	1C	Hull

November 1st, 1890.

Blake, Fredk. J.	2C	L'pool
Bowman, P. M.	2C	Sunderl'd
Brooke, Wm. .	2C	"
Dallas, David ..	2C	L'pool
Dickenson, T...	1C	"
Dunt, W. R. ..	2C	"
Foord, John C.	1C	London
Foster, John ..	2C	L'pool
Griffiths, Edwin	2C	"
Groves Wm. R.	1C	Hull
Hart, Edwin J.	2C	Sunderl'd
Hauxby, Thos.	1C	"
Hunt, Frank R.	2C	Falmouth
Jolly, Geo. H.	1C	L'pool
Legg, Wm. S...	2C	Aberdeen
Liston, Alex. ..	2C	L'pool
Mannington, C.	1C	"
McDonald, J. C.	1C	Aberdeen
Milne, Wm.....	2C	"
Newton, T. P...	2C	Sunderl'd
Phin, Jas.	2C	London
Reeves, Jno. Jas.	2C	Sunderl'd
Smith, Alex. ..	2C	Aberdeen
Still, Jas. C. ..	1C	"
Thomson, C. L.	1C	"
Trotman, W. H.	1C	London
Watson, F. S...	1C	Hull
Watson, James	2C	Aberdeen
Watterworth, L.	1C	London

November 8th, 1890.

Bain, Walter ..	2C	Leith
Barnes, Thos. ..	1C	L'pool
Chard, A. W. ..	1C	London
Clews, H. A. ..	1C	L'pool
Fanner, Geo. H.	2C	London
Harvey, John ..	1C	Glasgow
Houston, P. H.	2C	Cardiff
Hully, F. C. ..	1C	London
Jones, William	1C	Cardiff
Lewis, Richard	2C	"
Macfarlane, Jas.	2C	Glasgow
McKersie, Jas.	2C	London
Naysmith, Alex.	1C	Glasgow
Pringle, R. H..,	2C	L'pool
Runcie, Jas. E.	1C	London
Service, Alfred	2C	Glasgow
Scott, John	2C	London
Snailum, Thos.	2C	Leith
Tannock, A.....	2C	Glasgow
Thorman, Thos.	2C	L'pool
Vance, Robt. ..	1C	"
Watters, John..	2C	London

November 15th, 1890.

Adamson, A. J.	2C	London
Allinson, J. J. R.	2C	L'pool
Barlow, R. A. ..	2C	"
Bishop, Geo. F.	1C	N.Shields
Brownless, F. ..	1C	London
Copeland, A. M.	1C	N.Shields
Craig, John	1C	Greenock
Cuddy, James..	2C	L'pool
Duckham, R. ..	2C	London
Fulton, Robt. ..	2C	L'pool.
Hamilton, H. D.	2C	N.Shields
Hamilton, Wm.	1C	L'pool
Heaviside, C. E.	2C	N.Shields
Hodgson, Wm.	2C	London
Hurst, Harry W.	2C	N.Shields
Hnscroft, H. T.	2C	Hull
Hutchinson, D.	1C	L'pool
Hutchinson, G.	2C	N.Shields
Hutchinson, T.	2C	"
Maddison, Josh.	2C	"
Mathie, Peter ..	1C	Greenock
McBride, James	2C	"
McGregor John	2C	"
McIver, Wm. ..	2C	"
McKechnie, A.	1C	"
M'Kay, Jno. ..	1C	L'pool
Morris, Thos. ..	2C	"
Oxford, Benj. G.	1C	"
Paradise, H. E.	2C	London
Procter, Geo. H.	2C	L'pool
Rea, Geo.	1C	Hull
Richards, Hy...	2C	L'pool
Rolls, Albert E.	2C	"
Rothwell, John	1C	Greenock
Shaw, Daniel D.	2C	"
Sillars, N.	1C	"
Smith, Joseph..	1C	N.Shields
Tossell, H. P...	1C	Hull
Whitehead, W.J.	1C	Greenock
Wilson, Jas. P.	1C	L'pool

The Marine Engineer.

LONDON, JANUARY 1, 1891.

It is generally understood and known in the Engineering profession that a large percentage of the work developed in the steam cylinder, and indicated in the usual way by the indicator diagram, is absorbed in the frictional resistances of the engine, up to from 20 per cent. to 30 per cent. of the total gross power. In land engines no doubt some considerable proportion of this may be represented by the frictional resistance of the bearings of a heavy fly-wheel, and the friction induced by the indirect action of the single cylinder operating a crank, producing much thrust on the bearings. In marine engines the same proportion of loss is a recognised fact, though the absence of any heavy fly-wheel, and the better distribution of the driving strain upon at least two or more separate crank-throws, should tend to diminish the particular resistances above pointed out. We have not heard of any special experiments having been carried out and reported, as to the complete analysis of the causes giving rise to this considerable absorption of power, which in the high powers developed by marine engines forms a most considerable item of loss. We have heard, however, of certain experiments having been carried out by an American engineer on the frictional resistance of slide valves with marine engines; the apparatus used consisted of a double pair of springs, through which motion was given to the valve. This apparatus was attached to the valve spindle, and the compression and extension of the springs were made to register on a gauge the exact power required to move the valve. Careful experiments were made at different points of cut-off and speed of piston, with the result that it was found that the power required to work the valve alone amounted to as much as the total of from 6 per cent. to 11 per cent. of the gross I.H.P. shown by the indicator. There can be little doubt from this result that there is likely to be an equal amount of resistance offered by the piston moving against the interior of the cylinder, and the balance could then be fairly accounted for by the friction of the cross head slides and of the propeller-shaft bearings and thrust block. As the saving of loss of power tells to double advantage in a sea-going vessel, both in economy of fuel and in reduction of fuel storage required, we should be glad to see more specific attention applied to the investigation, analysis, and reduction of these special losses. It is true that much has been done in the reduction and removal of back pressure upon slide-valves, but we have never heard of much attention being paid to the actual frictional resistance of the sliding movement of the piston in its cylinder; nor have we heard of the substitution of rolling friction for sliding friction in cross-heads and bearings, though we think the oscillating cylinder ought to have some effect in reducing the total friction by absence of the sliding cross-head. It is a subject of some interest to inquire what part the resistance of a piston in a cylinder may play, as an item of the total loss referred to, and we should be glad to hear of any data with which sea-going engineers might be acquainted upon this point. We have no doubt that this item would depend very much upon the accuracy of the bore of the cylinder, for should the bore be slightly taper, spring rings with great force must be employed to make a steam-tight joint upon the periphery of the piston. The latest improvements in modern tools ought now-a-days to ensure the perfect parallelism and accuracy of the cylinder bore to a much greater extent than heretofore, and as a consequence a steam-tight fit could be ensured with a minimum of spring pressure. Excess of spring pressure is undoubtedly to be avoided, not only on account of the friction of the resistance thereby set up, but also as a rapid cause of wear and tear on the cylinder face which is liable to irregular development by reason of difference of quality of the cast iron in different parts of the cylinder, which eventually necessitates re-boring. It is possible that the concentration of the spring pressure upon a ring surface of small width would serve to accentuate this tendency to excessive wear and tear, and that a more lasting and uniform result might be obtained by a greater width of spring to reduce the frictional resistance of the piston within the cylinder to the greatest possible extent. It would appear, then, that that which is desirable would be extreme accuracy of bore, permitting a steam-tight joint to be readily effected with a minimum of spring pressure, and that this spring pressure should be as uniformly distributed as possible over a ring made as flexible as may be, and that the bearing area of these rings might with advantage be greater than those usually employed. It is possible also that balanced piston valves might on the whole present less frictional resistance to motion than any form of more or less balanced slide-valves. This seems a subject which would well repay more specific attention on the part of designing and constructing marine engineers.

Mr. Seaton, Member of the Council, I.N.A., deserves the thanks of the iron and steel trades at large for the credit he has given to these bodies for their constant endeavours to facilitate and achieve novelties in construction to meet the wants of designing Engineers and Naval Architects. There is no doubt that the designer is too often hampered by the commercial difficulty of obtaining the particular constructions he would desire to use. When we turn back to early examples of engineering invention, we cannot be but struck with the crudeness of the details that had to be used by the most successful inventors in the attainment of their ends, as for instance when we think of the granite tube plates employed by Trevithick, and the crude unturned cylinders and pistons employed by Newcomen; it must be obvious to all that the mere mechanical operations and handicraft skill, taken as a matter of course, in the present generation, must have required as much ingenuity and invention as in the origination and invention of the primary principles of steam engines. It is probable that the authors of these accessory details are not unknown, but the originators of these improvements in production are practically forgotten, though a very short time has elapsed since their introduction. Coming to modern days, the introduction of Siemens steel plates caused the old Staffordshire list of extras to be practically abandoned by steelmakers. This had more to do with the progress subsequently made in boiler construction than the introduction of a material of superior strength, inasmuch as it made it possible to construct a boiler with a small number of plates in the new material at a less expense than an older-fashioned boiler with a large number of plates of small size; the larger plates could have been supplied some twenty and more years ago, but the special expense attached to them as an extra size practically kept them out of the boiler market. This consideration of cost very often stands in the way of a step in advance until the price of production by the ingenuity of the producers has been brought down to a commercial basis. The iron and steel trades have well deserved the thanks of designing engineers for the energetic manner in which such cases of cost have been tackled and eliminated. There is, however, doubtless much to be done by these trades yet, and we shall be glad to hear that steel castings may be obtained readily in the market without blow-holes and of homogeneous character throughout, steel forgings absolutely free from hair marks ⅛ of an inch below the surface, and steel plates knowing nothing of the "blue-black" state, and that can be absolutely relied on to stand a desired maximum strain throughout. In boiler construction at one time the best quality that could be produced was dependent upon the use of Lowmoor plates, the price of which was very high (as compared to that of steel at present) averaging as much as £30 per ton, and for high pressure there was no alternative but to employ heavy dimensions. The introduction of Siemens steel, and the ingenuity of Mr. Sampson Fox and others in the production of corrugated and flanged tubes, have provided a material of a strength fully 30 per cent. higher than that of iron, and a method of construction affording a great increase of rigidity to resist collapsing strain. The demand also for speed in the great liners produced a demand for vessels, larger and more costly in construction than hitherto known, and resulted in iron vessels with compounded engines. The result was a gain of two knots per hour, equal to 13 per cent., but with an increase in coal consumption of 50 per cent., and an increase of carrying capacity of only 5 per cent. The development of the steel industry for both framework and machinery admitted the possibility of many specific improvements reaching a practicable limit of 20 knots per hour, with a smaller percentage of dead load, and therefore a higher capacity for paying load, and with finer lines, giving the same speed with less horse-power. To meet this demand of lighter and stronger frames, bars of Z section are now produced by iron-masters at reasonable rates. The mild steel now put on the market is capable of being so flanged, even when cold, that there no longer exists any necessity of riveting to the plate an angle-bar if it is sought to stiffen it or connect it to other work. The increase of speed has also now largely been attained by an increase in the revolutions of the engine, and in the higher initial pressure of steam with greater grades of expansion, and thus the higher speeds are attained with the least possible increase in the weight of material employed, the introduction of steel both in the boilers and in the engines making possible the increase of strain in their structures without material increase of weight. The introduction of forced draught is also a step in the same direction, viz., the increase of the rate of evaporation without increase in the size and weight of the boilers, the success of which will be largely dependent upon the quality of the materials employed in the construction of the boilers, etc. A hasty analysis of the progress thus made in marine and other engineering strongly mark the valuable aid that has been given to designers and constructors by the energy and enterprise of the iron and steel trades in providing improved methods and forms of construction whereby the requirements of the designers can b effectively carried out.

THE constructive staff of the United States Navy has before now been augmented by members who have had a course of scientific instruction at our Naval College at Greenwich, and practical insight into the methods of work in vogue in some of our most notable shipbuilding and engineering establishments; and now we learn that a further batch of young American Naval

Officers are about to invade this country, by order of the secretary of the United States Navy, for similar tuition, preparatory to their appointment as Assistant Naval Constructors. The party, it is intended, will be divided into three sections, one section going to the Clyde district, where they will attend Professor Jenkins' classes on Naval Architecture at the Glasgow University; another section will be located in London, where they will attend the Naval College at Greenwich; while the remaining section will go to the Continent and attend one or other of the leading Naval colleges there—probably that at Paris. Eminent firms are being applied to in the several localities to afford the necessary facilities for the young men having practical insight and training in the work of ship construction and engine-making. The idea of callow youths being sent to Britain to graduate for the situation of Assistant Constructors to the American Navy is regarded by some as bordering on impertinence, but doubtless this will not be regarded by Brother Jonathan as any insuperable deterrent. The purpose really being to make Americans thoroughly independent of British or European help in the matter of building warships, it is thought that along with these young officers—thirsting for knowledge and experience—the Americans ought at least to have sent orders to British builders for warships, in the construction of which these youths could have had the best of practice. Other nations have done and continue to do this, and why not the rich folks across the herring pond? But after all we are a liberal people, and doubtless, in spite of the way in which the proceeding is regarded by many, the Americans will soon be in positions enabling them to "scoop-in" the coveted knowledge. Up till four or five years ago Americans had to come to this country for designs—principally for engines—and even now when depending more on their own resources proofs are not wanting that they sadly need a helping hand. They are steadily advancing, however, as much by the system of "trial-and-error" as by any superior original scientific or technical skill—although the constructive board now includes one or two capable and highly trained designers. The mission of the young naval officers is in itself proof of the desire for still greater knowledge, and the building programme, 1890, of the U.S. Navy is sufficiently elaborate to furnish scopefor its exercise when acquired. The programme includes 25 vessels, 4 battleships, 9 cruisers (6 being protected), 1 coast defence vessel, 4 monitors, 4 gunboats, a dynamite cruiser, a torpedo cruiser, 2 torpedo boats, and 1 practice ship. Five new warships were commissioned during the year, and three cruisers and an armoured ship are being fitted out, while 16 new vessels, mostly of high class, are under construction. The American President has appointed a commission to fix on a suitable site for a naval yard on the Gulf of Mexico, and the manufacture of nickel-steel armour plates is to be started in the States; while at Washington the Navy works have had extensive ordnance constructing plant laid down. One hundred heavy guns have been ordered from private firms, and thus a new industry has been set agoing.

THE DEVELOPMENT OF THE MARINE ENGINE, AND THE PROGRESS MADE IN MARINE ENGINEERING DURING THE PAST FIFTEEN YEARS.*

By A. E. Seaton, M.I.C.E., M.I.M.E., M. Council, I.N.A.

(Continued from page 397.)

WHERE forced draught has been used in the Mercantile Marine for speed purposes, I hear of little or no complaint, but when introduced for the sole purpose of effecting economy of fuel, the praise is of a very qualified nature, and the complaints, when made, are unmistakable.

To sum up, the three great *developments* of marine engineering that have been made in the past ten years are—

1st. Increase in working pressure from an average of 75 lbs. to an average of 150 lbs. per square inch.

2nd. The adoption of the triple and quadruple-expansion system, so as to utilize steam of this high pressure efficiently.

3rd. The adoption of artificial means for obtaining sufficient draught for the consumption of coal, and, when desired, for an increased consumption of coal so as to give an augmented supply of steam without additional boiler capacity; with the result that in naval ships now with practically the same weight of machinery, the indicated horse-power is nearly doubled, and in the Mercantile Marine the indicated horse-power is 50 to 75 per cent. more for the same weight of machinery as was used fifteen years ago, the consumption of coal being 20 per cent. less than ten years ago, and 25 to 30 per cent. less than fifteen years ago.

I now come to the *progress* that has been made by the marine engineer in the design and manufacture of machinery, whereby the engine of to-day, notwithstanding that it is lighter and even cheaper than that of fifteen years ago, is worked with less wear and tear and fewer accidents. Although, from the tremendous demand made for sea-going engineers (so that the supply has not been all that could be desired), the marine machinery of to-day is probably not in the hands of such experienced and skilful men as then, it does not suffer thereby, while at the end of twelve months' work it is in better order now than was the case fifteen years ago. I do not wish by any means to disparage the skill and ability of our sea-going engineers, but I think that I shall be supported when I say that younger faces are to be seen in the engine-rooms to-day taking important positions there, than was the case fifteen years ago; that whereas then a natural taste and aptitude for the profession was a *sine quâ non* for entrance into it, it is now flooded to a great extent by young men who simply look on it as being more lucrative than some other professions and trades to which admittance is easy have now become.

That constant complaint of hot bearings is practically become a thing of the past is partly due to improved construction and better design, consequent on a better understanding of first principles; but good white metal has done almost more, as it has been found to be a panacea for the evil where it has existed for years in the older engines; and whereas formerly it was only warships and those of the best mailship companies that indulged in the luxury of white metal, now the meanest of steamships has, as a rule, this metal in the main bearings, and crank-pin brasses, as a matter of economy; for a hot bearing always means an expensive bearing, both in coal consumption and in wear and tear and renewals. The increased length of life of crank-shafts is due to the absence of hot bearings, as well as to the lighter strains put upon them. It is white metal that has permitted of the high number of revolutions per minute that I have already pointed out as being one of the conditions of high speed in ships.

I would also express the opinion that the crank-shaft of to-day is better made and of better material than was the case fifteen years ago. Improved methods of manufacture of iron forgings' and the improved steel which you, gentlemen, give us, admit of a better surface, and the well-made and heavy lathes of the present day can do the work not only cheaper, but truer than was the case then. It is to be hoped that the combination of the crank-shaft makers in England, whereby the price is kept up, will act in maintaining the quality and, if possible, raising it beyond what it was when competition was so severe.

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* Read at the meeting of the Iron and Steel Institute, Pittsburg, United States of America.

In the construction of the modern marine engine the most marked feature of change is the quantity of steel castings introduced, sometimes in the place of forgings, sometimes in the place of iron castings, and sometimes in the place of brass castings. I ventured, more than twenty years ago, when I was a student of engineering, to predict that the time would come when we should get steel cast into the various forms we required, and that, with the introduction of such a metal, cast-iron would gradually disappear from the marine engine. My prophecy has been fulfilled, in a sense, sooner than I anticipated, but cast-iron has not yet been driven from the field as rapidly as might have been expected after the introduction of steel castings. The fact is that you, gentlemen, have not yet learned the full secret of success; and I do not say this reproachfully, for so many of your members have worked energetically at the problem and have improved in your productions in such a comparatively short time, that you deserve praise rather than censure. We engineers do complain—sometimes very savagely—of the delays we experience in obtaining steel castings, and of the loss to us when, after machining for days, we open up such faulty places as to necessitate the condemnation of the castings; but in our calmer moments we are fain to admit that our wonder should rather be, not that bad castings are made, but that we sometimes get good ones. Ten years ago my firm commenced using steel castings in lieu of iron ones, for such parts as were subject to shock, and were of so plain a design as to be easily cast. We then substituted cast steel for forgings, the strain per square inch on which was very light. For these purposes all we required was a material whose ultimate strength was at least twenty tons, and which, before breaking, would stretch at least 5 per cent. At that time our particular sources of supply were Messrs. W. Jessop & Sons, Limited, Sheffield, and Mr. Aesthöwer, of Annen (Germany). The German castings were very sound, and came up to the standard laid down, but went very little beyond it; while those of Messrs. Jessop & Sons were only fairly sound, but they possessed a tensile strength of thirty tons, with an elongation of 20 per cent., and in some cases they were even better than this. With these latter we ventured to go further than we had done before, and we made of them some of the smaller working parts, which were subject to higher strains, and eventually the connecting-rods for two engines of considerable size. These rods have now been running for seven years without showing signs of failure. Messrs. Jessop have made crank shafts of large size of this material, even, I believe, to 15 in. diameter, with most satisfactory results, and the castings, when machined, were free from blowholes, draw-cranks, and even sponginess, while they had all the appearance, when finished, of having been forged. The pieces cut from these castings, when tested, were found to have as high a tensile strength and as good an elongation as a steel forging, so that, from *primâ facie* considerations, such a shaft was equal to a forged one, and I am not aware that experience has proved the contrary. To-day we are constructing in the works of my firm (Earle's Shipbuilding & Engineering Co., Limited, Hull, England) engines of 12,000 H.P., in which the foundations, the whole of the columns, the pistons, the thrust-blocks and collars, the eccentric straps, the cylinder and valve-box covers, and many other of the minor details are made of cast steel. The saving of weight is such, that, taking *one* of these engines—they are twin screws, it is half the boilers, that is to say, taking a set of machinery of 6,000 H.P., its weight is 560 tons against 900 tons, the weight of a set of engines, boilers, &c., of 6,000 H.P. made in 1870, and 1,000 tons that of compound engines in 1875, and which at that time were deemed to be the lightest of the kind, and were run at very nearly the same number of revolutions as the modern one. The ship for which our engines are intended is being built by us, and has a cast steel stem, a cast steel stern-post, a cast steel rudder, and cast steel propeller brackets, besides other cast steel fittings for gun and other purposes throughout the vessel. The fact is that our demand for steel castings is now large, and is, moreover, a progressive one; and when you, gentlemen, by means of aluminium, nickel, or any other "doctor," will give us sound castings that we can rely upon, so that we may not throw away our money by machining, only to discover defects by which the castings are condemned, we will prove even better customers than we are now.

In 1875 Messrs Vickers, Sons & Co., of Sheffield, were making very large crank-shafts and other shafts; and in the Atlantic it was getting to be the custom, when a shaft broke, to substitute one of Vickers' for it. They were, however, a very expensive luxury; and as the wrought-iron shaft generally gave its owners timely warning of when it was going to break, and the steel one did not, the latter was treated as untrustworthy, and was not adopted by the majority of engineers or shipowners. To-day, instead of there being only one firm that can make these shafts, we have a dozen, and at least half-a-dozen of these whose reputation stands in the first rank. The Siemens furnace now produces steel for shaft purposes at as low a rate as ruled for the Bessemer in 1875. The substitution of hydraulic presses for steam-hammers, too, has not only improved the quality of these forgings, but most undoubtedly has been the means of reducing their price, and we now have steel crank-shafts, steel propeller shafts, steel piston and connecting rods—in fact, every forging of steel in a warship and in the highest class of mail-steamers, and throughout the Mercantile Marine there is a general tendency to substitute this superior metal for the inferior. In H.B.M. Navy the shafting is made in accordance with the plan introduced by myself in 1872, whereby, by making the shafts hollow, a considerable reduction is effected in weight, with an exceedingly small reduction in strength. For example, a shaft 10¼ in. external diameter, with a hole 5 in. diameter through it, is equal in strength to a solid 10 in. one, but its weight is only a little over three-fourths that of the solid one. I need hardly say, however, that the difference in cost is considerable; in fact, there is the added cost of boring out the hole. Siemens steel is now very little dearer than ordinary crown quality iron, and no dearer than the best qualities of iron required by marine engineers, so that all the bolts, studs, nuts, and pins used by my firm are of steel.

The general effect of the substitution of steel for iron in the construction of a marine engine is to save weight, and at the same time to have a stronger machine. The modulus of elasticity being with steel only about the same as that of iron, renders it impossible to make any very substantial decrease in scantlings of many of the parts, but generally such a decrease is effected, and so the modern engine, composed almost entirely of steel, is lighter than one of iron. The collapse in the s.s. *City of Paris* has no doubt shaken the minds of some as to the use of steel castings; but I think it has been proved most conclusively at the trial that the accident was not in any way due to the steel castings, and that they did give way is perhaps not to be wondered at under the circumstances. At the same time I am of opinion that it is unwise, with our present knowledge of the trade, to cast columns hollow, *i.e.*, cored throughout their length. It is, of course, possible to do this successfully, but the risk of it is great, and the liability to obscure cracks and unseen faults must be also great. At all events, my experience with the material has taught me to avoid such a form as far as possible, and certainly never to make an important part like a column of an engine a hollow casting, more especially with a thin section.

I do not suppose it is of equal interest to your Institute, but it is nevertheless a fact that very marked improvements have been made in the manufacture of bronze castings and also of bronze forgings. Fifteen years ago a gun-metal casting, with an ultimate strength of 15 tons per square inch, and an elongation of 5 per cent., was considered very satisfactory; but to-day we have the various bronzes, such as phosphor bronze, manganese bronze, Stone's bronze, aluminium bronze, &c., &c., having strengths varying from 20 to 30 tons per square inch, and in some instances even a higher ultimate tensile strength than 30 tons, with an elongation approaching that of steel. Forgings made from some of these metals have proved to be equal to steel in strength, and the cost of these bronzes is very little beyond that of gun-metal. Advantage has been taken of this by the marine engineer to use forgings of these metals in lieu of brass castings, drawn bars in lieu of either brass castings or iron forgings cased with brass, and, finally, to make propeller blades of it instead of cast-iron, steel, or even gun-metal. I will not detail here the gains in speed attributed to the substitution of the bronzes for steel or iron, but content myself with accepting as a fact, and stating the same to you, that propeller blades being made of thinner sections, having keener edges and a smoother skin, give a better result than the heavy cast-iron blades did, or than the steel can possibly do when pitted and roughened by sea-water. The action of sea-water on these bronzes is sometimes capricious, but generally only slight. The English Admiralty, acting upon their own experience, have discarded the use of all the bronzes except phosphor bronze and ordinary bronze or gun-metal (consisting of 87 per cent. of copper, 8 per cent. of tin, and 5 per cent. of spelter). So far this distrust of other bronzes is not shared by the Mercantile Marine. I have, however, seen some remarkable failures with certain of the bronzes For example, a new propeller fresh from the makers was found, after lying on a wharf for a few weeks subjected to severe frost, to be cracked so seriously as to be utterly useless. It is also a thing not unknown to the Mercantile Marine to lose one or more propeller blades without notice; and as indicative of the direction in which engineering opinion may be tending, the latest thing in propeller blades we hear of is a bronze casting with a cast steel core, or perhaps you, gentlemen, would prefer to say a steel casting with a bronze skin.

The progress in propeller design and construction has been very slight, although each month seems to produce a new inventor with a new propeller—at least new to the inventor—that is going to revolutionise the shipping world; but in spite of newspaper paragraphs full of hope and promise, if, alas! somewhat showing great want of scientific and technical knowledge of the first principles of propulsion, the screw propeller remains without a rival. Its shape has not altered much, although the very bad forms have gradually died out; and although much has been claimed for those having the pitch varying in all kinds of ways, the fact remains that in the Navy, as in the Mercantile Marine, those who have given most thought to the subject and most observation, prefer a propeller of uniform pitch throughout—in other words, it is desired that its acting surface shall be part of a true helix.

Propulsion by twin screws has many practical advantages, but it is chiefly now adopted from considerations of safety, inasmuch as a ship with two screws is less liable to have both injured at the same time, and therefore her whole propelling apparatus broken down, than one with a single screw; and in case of accident to the steering gear, she can be steered by varying the revolutions of the engines. Moreover, a smaller propeller is required for each of the twin-screw engines than that needed for a single engine of same power; hence in the case of a deep-draught ship, owing to the deep immersion, the twin screws work with a higher efficiency, and in the case of a shallow-draught vessel the same holds good, inasmuch as they are thoroughly immersed when the single screw of the same power would be partly out of the water.

The adoption of steel boilers naturally suggested the advisability of using fresh water, not so much on grounds of cleanliness as of avoiding corrosion. This bugbear, however, has proved, like many others, not to exist. Experience has shown that the steel boiler does not corrode any more rapidly than the iron one; and, as a matter of fact, the life of boilers made of steel is likely to be very considerably longer than that of iron ones. The first steel boilers made by my firm twelve years ago are working at their original pressure, under the inspection of the British Board of Trade and Lloyd's, and they are likely to continue to do so for many years yet to come. I am, of course, aware, and would remind you, that this increase of length of life is due in no small degree to the better treatment accorded to them. The use of zinc in the form of cast slabs or rolled sheets, especially in the earlier months of their life, has been the means of preserving boilers in a way not known before; and the general practice of causing the feed water to enter the boiler at a comparatively high temperature has also tended to increase their durability; but I repeat that under the same conditions the steel boiler shows no tendency to corrode any faster than the iron one, and the steel boiler has, besides, the advantage over the iron one of not developing blisters in the internal parts exposed to flame, so that the patching of furnaces is a comparatively rare thing nowadays.

The demand for fresh water for feed purposes has been emphasized since the use of steam of 150 lbs. pressure and upwards, especially for vessels making long voyages. It goes without saying that the power to generate steam in any boiler must decrease very quickly as the scale on the heating surface increases, and also that the temperature necessary to produce steam of a certain pressure gets higher as the density of the water increases; hence, when the waste is made up with sea-water in boilers whose working pressure is 150 lbs. and upwards, the speed of the ship decreases towards the end of the voyage, and, what is worse, the boilers often give out, and require extensive and costly repairs. The consumption of coal is also very much higher than it would be if the boilers were kept clean throughout. Attempts to remedy this evil were first made by carrying a supply of fresh water in the double bottoms of the ships or in tanks specially provided for the same. This expedient helped matters, but was not a perfect success, as the water supply often contained large quantities of sulphate and carbonate of lime, which formed a hard scale, and which, together with the sea-water, made a worse scale than the sea-water itself—that is, worse to deal with afterwards. This water also cost money, and, what was more objectionable, the carrying of it often reduced the quantity of cargo. Other attempts were made to supply fresh feed to the boilers by means of the donkey-boiler, the steam from it being condensed in the condenser and pumped into the main boilers. The donkey-boiler, however, became then a sufferer. As a rule, they are not easily cleaned, so that it was only a matter of time for this source of supply to fail, and to be not available for some days. Finally, Mr. James Weir, of Glasgow, whose inventions, especially for improving the efficiency of the boiler, are of wide repute, introduced his now well-known evaporators, which consist really of a small horizontal boiler, ingeniously contrived, so as to be easily taken to pieces and cleaned, and the water in it evaporated by the steam from the main boilers passing through a set of tubes placed in its bottom. The steam generated in this boiler is admitted to the low-pressure valve box, so that there is no loss of energy, and the water condensed in it is, of course, returned to the main boilers. The extra supply from it is still obtained at the expense of coal, but without any risk of injury, and at a more economical rate than was the case when a donkey-boiler was employed. Other engineers have designed and patented apparatuses to do the same work, and it is now getting to be a universal practice for all ocean-going steamers to have feed evaporators. Mr. Weir's feed-heater, whereby the feed water, before entering the boiler, is heated up very nearly to boiling-point by means of the waste water and steam from the low-pressure valve-box of a compound engine, is another most useful appliance, and was introduced in 1878; it is also becoming every day more and more used, and, in conjunction with Mr. Weir's special feed pumps, is a very desirable thing to have in every steamship, as not only is the feed water delivered to the boiler warm, but so regularly, and with such very slight risk of cessation, as to render the engineer on watch quite easy on the score of feed supply.

It is claimed for many feed-heaters that they are the means of effecting an economy ranging as high as 15 per cent. I mean marine feed-heaters, where the heating is done by steam, and not by waste gases in the uptake. It is not obvious how there can be any saving at all, and in my opinion the tens and fifteens per cent. are apocryphal. That steam is better maintained in the boilers with such appliances is undoubted, and that in cases where difficulty has been experienced in keeping up the full pressure, the fitting of a feed-heater has been the means of doing it; so that there must be some saving, although in the nature of "robbing Peter to pay Paul." The fact is, the warm feed assists rather than retards the circulation, and the saving is more in that direction than in any other.

Improvements have been made in the engine-room and boiler-room of nearly every steamer in the direction of making the work lighter, both at sea and in port, and the occupation of the engineer not so severe. Ventilation has been better understood and practised. The covering of the hot parts by non-conducting material has been extended, and the substitution of superior non-conductors, such as fossil meal and asbestos compositions, has unquestionably effected a saving. Steam starting gears, too, have, during the last fifteen years, been introduced into all classes of ships, and even the smallest of them now may be found provided with this appliance for the more rapid handling of the engines. Steam turning gears and steam ash hoists have been also introduced, and all such fittings must naturally tend to the more economical working of the vessel.

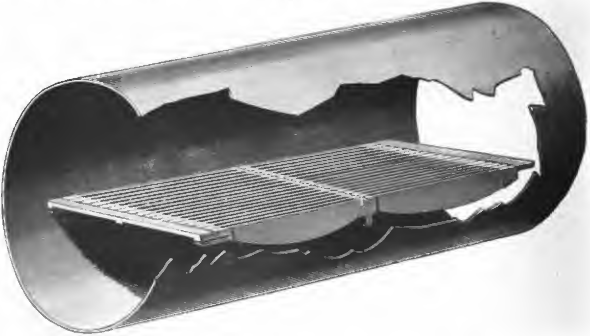
In conclusion, I would beg to summarise by saying that in fifteen years the speed of steamships carrying passengers has been increased from 30 to 40 per cent.; the consumption of coal per horse-power has been decreased from 20 to 30 per cent., or say an average of 25 per cent.; the cost of horse-power has been decreased by almost a similar amount, and in some cases is but a half of what it was in 1875; and the safety, comfort, and convenience of the travelling public has been enhanced instead of sacrificed. These successes are largely due to the members of the Iron and Steel Institute, and the balance is due to the skill and ability of marine engineers, but it must not be forgotten that the whole has been backed by the enterprise and sagacity of the shipowners.

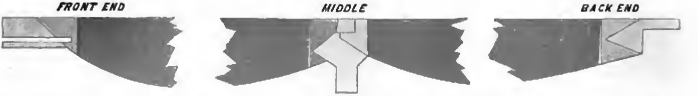
THE SUBMARINE BOAT "PERAL."—This boat, which at one time received high praise, was finally reported upon unfavourably by a Government commission. The Government at last decided that a new boat should be built under the superintendence of Senor Peral. The construction was, however, to be subject to so many restrictions that Senor Peral asked to retire, in order that he might be able to speak freely on the matter. Contrary to the usual practice his retirement has been formally refused.

MORGAN'S LOCKING FURNACE BAR.

Of new furnace fire bars there seems to be no end. The one we now illustrate seems to be simply an improvement on the old well-known type of bars, only much improved by the introduction of an arrangement by which they become self-locking.

The chief advantages these bars possess over the old ones lie in the impossibility of their *lifting* when being picked, and the more than usua lclear air-spaces they afford, through their mode of construction. The bars being immovable the air spaces must always be the same, and no opening-out gaps can occur to allow of unburnt coal falling through, so that the coals must be burnt to the fineness of the bar spaces before falling to the ashpit, and this, of course, implies a saving of fuel.





Our illustration shows the simple but effective mode of locking, and the patentee, Mr. D. J. Morgan, of the Central Engineering Works, Cardiff, claims that they are not only more effective than the common bar, but are also the cheapest, because they last longer, give increased speed with reduced consumption, and can be replaced with ease without drawing fires. The increased speed claimed for these bars—which, by the way, are by no means untried, they having already been fitted to the combustion chambers of many boilers—is readily understood, for nothing conduces more to steady easy steaming than a good clear grate, free from clinkers and without gaps, and firemen can "go" for the clinkers with a will, knowing that the bars will not rise while doing so.

From the number of testimonials sent to Mr. Morgan from engineers of high standing as well as seagoing chiefs, copies of which he has sent to us, we have little doubt of the value of the arrangement, and are not at all surprised at the success they already seem to have achieved.

INSTITUTE OF MARINE ENGINEERS.

The second conversazione held under the auspices of this institute took place most successfully on December 5th in the Town Hall at Stratford, the attendance of ladies and gentlemen being about 600. The arrangements for the gathering together and furnishing amusement and the good things of life to so large and brilliant an assemblage was entrusted to a committee composed of Messrs G. Wiltshire, H. W. White, J. C. Sage, J. W. Richardson, J. Robertson, R. Leslie, J. W. Dimmock, W. J. Craig, J. D. Bisset, with Mr. Jas. Adamson as convener, and right well did they perform their duties.

The entertainment took the form of a promenade concert, for which a first-class programme was provided, and most ably carried out by a talented number of young ladies and gentlemen, the music, both vocal and instrumental, being of a high order. Refreshments were supplied at two large bars occupying the whole end of the hall facing the platform, and were done ample justice to. The large hall was beautifully decorated, and the whole assemblage had a most brilliant effect. Speeches were wisely not made a feature of the evening, but we had a few words from the chairman of the institute, Mr. Manuel, P. & O. Co., and a most interesting explanation of the phonograph, accompanied with illustrations of its working, by Mr. McFarlane Grey.

Altogether the conversazione was a great success and very enjoyable, and reflected great credit to all concerned.

THE DARDANELLES NAVIGATION.

IT may not be known generally that the Dardanelles are a more frequented maritime highway than the Suez Canal. During the twelve months from March 1st, 1889, to February 28th, 1890, the number of vessels using the Straits reached 14,659, with a tonnage of 10,057,827 registered tons. These figures were, however, inferior to those for 1888 by 1,160 vessels, and 402,536 tons, because an exceptionally large transport of cereals shipped from Black Sea ports to European ports passed the Dardanelles in the former period. Nevertheless the numbers for 1889 exceed the Suez Canal traffic of the same period by 11,234 vessels and 3,274,640 tons. As to the nations engaged in the Dardanelles navigation, England testifies her enormous supremacy, as 6,025 ships, with a tonnage of 6,564,069—or about two-thirds of the entire tonnage—sailed under her flag. The next in importance are 3,951 Turkish vessels, tonnage 349,398; 2,479 Greek vessels, tonnage 918,103; followed by Italy, Austro-Hungary, France (349 vessels, tonnage 427,654), Russia, Germania, &c. Whereas the German, Danish, Dutch, Turkish, Swedish, and Norwegian vessels showed considerable increase in their tonnage during the last years, Austro-Hungary, Russia, and France have lost ground. In the latter case the reduction of 517,048 tons in 1887 to 427,654 tons in 1889 is accounted for by the *Salonica*—Constantinople service of the "Messageries Maritimes"—having been suspended since March 31st, 1888. Like everywhere else is the number and tonnage of steamers also continually increasing in the Dardanelles at the expense of sailing vessels. In 1887 there were 7,506 steamers with 7,641,877 tonnage, which figures had increased last year to respectively 8,998 and 9,440,986. The steady growth of the Dardanelles traffic is only partly due to the general development of maritime enterprise, and principally to the facilities offered by the Ottoman authorities to the flags of all nations visiting Turkish ports.

Both for the safety of the vessels and for their better supervision, all ships coming from the Archipelago are forbidden to enter the Dardanelles before sunrise or after sunset, except the mail boats from Marseilles belonging to the Messageries Maritimes, the Austrian Lloyd's Trieste mail steamers, and the *Florio* and *Rubattino*, mail ships from Brindisi. All other vessels which reach the Strait after the lights are extinguished, as an indication that the sun has set, anchor outside the fortresses of Namazieh and Tchimenlik. Before entering the Dardanelles both steamers and sailing-vessels have to undergo an official examination of their papers and their sanitary condition, any contravention being punished with fine from 37s. to £10. In case the captain is not provided with a certificate of health from the port he left, his vessel may have to undergo a quarantine, unless he is able to prove that he touched at no contaminated port. The charges of the Turkish ports are at the rate of 10½ centimes (1 penny) per ton for the first 500 tons; 6½ centimes per ton for the second 500 tons; and 4½ centimes per ton for the remaining tons. This tax is levied as well on vessels coming from abroad as on those sailing from one Turkish port to another. Ships bound for Constantinople from whatever port, and those which pass the Dardanelles, to or from the Black Sea, pay at Constantinople, viz., at the Galata office if they come from the Archipelago, and at the Asiatic Carak office if they arrive from the Black Sea. The sanitary board exercises its visiting right only on vessels from abroad and bound for a Turkish port situated between the Dardanelles and Constantinople. The tax once paid on arrival at Galata or Carak entitles to free passage to the port of destination mentioned in the bill of health. The latter must be presented and "vise" at every intermediate port, but applies to the whole journey in one direction.

LAUNCH OF A DREDGER FOR THE MANCHESTER SHIP CANAL.—Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched into the Manchester Canal a powerful steam dredger, capable of lifting 400 tons per hour from a depth of 26 ft. This dredger, which has been built to the order of Mr. T. A. Walker, is intended for dredging the Salford division of the canal. The builders shipped this dredger in pieces, and erected her on the canal from where she was launched.

NEW STEAMER.—The directors of the Southampton and Isle of Wight Steampakect Co. have contracted with the Southampton Naval Works, Limited, at Woolston to build a fast paddle steamer for their Isle of Wight traffic.

H.M.S. "THUNDERER."

THE solid old ironclad *Thunderer*, which has just been fitted by Messrs. Mandslay, Sons & Field, of Lambeth, with new triple-expansion engines of 7,000 H.P., and is now on the eve of undergoing her trials, has received the first four specimens of a gun from which great things are expected. The original armament of the *Thunderer* consisted of two 38-ton and two 35-ton muzzle-loading guns, and it may be remembered that one of these burst, during practice, inside the turret, with fatal results. It was pretty generally believed that the cause of the accident was that the gun was twice loaded before firing. The new guns, two of which are mounted in each turret—and the turrets are clothed with 14-inch armour plates, which, though only of old-fashioned wrought-iron, would stand a great deal of hammering—are of 10 in. calibre and 30 tons weight. The total length is 26 ft. 10 in., the projectile weighs 500 lbs., and the full charge of powder is, as is now usual, just half that weight. At a range of 1,000 yards it is calculated to pierce 21 inches of wrought-iron plate, while the 12 in. 45-ton gun is only credited with power to perforate a plate thinner by four-tenths of an inch. Besides the *Thunderer*, the *Devastation*, and the two new second-class battleships, *Barfleur* and *Centurion*, are all to be armed with a quartet each of these weapons. They are the heaviest guns yet constructed to be worked by hand power, and it is probable that in their case the extreme limit of size and weight has been reached in this direction. They are mounted on ordinary Vavassenr slides with hydraulic buffers for taking the recoil. The trunnions are accurately balanced on knife-edge bearings, but an arrangement is fitted whereby the shock of the gun on the trunnions—should it be fired with sufficient elevation to cause a downward thrust on the excessively delicate knife-edge bearings—is transferred to the broad main bearings themselves. This plan facilitates elevating or depressing the gun. The training is done by causing the turrets to revolve, a double set of racks or toothed wheels being fitted round the base of each turret, into which a vertical shaft with pinion is geared. This shaft is worked by a steam engine well down below out of the reach of shot. The turret is also capable of being revolved by hand gear in the event of the turret-turning engine being disabled, but the operation would naturally be slow. The breech mechanism is similar to that of the 9·2-in. guns, consisting of a breech-piece on the well-known interrupted screw principle, and safety arrangements are fitted whereby it would be impossible to fire the gun unless the breech-piece had been properly locked. The shot and cartridges are hoisted by pulleys worked by hand, but about 60 rounds of common shell and shrapnel are kept in a rack inside the turret ready for immediate use. The weight of these projectiles also counterbalances the weight of the muzzles of the guns projecting from one side of the turret, and so renders the work of turning it much more easy. The loading-trays are run on rails inside the turrets, and are guided to the breech of the guns by pulleys and tackles. It is to be feared that in a seaway, with projectiles weighing at least 500 lbs., the tendency to sway and swing about might lead to bumping the breech of the gun, and thus injuring its mechanism, but this appears to be the only weak point about the gun or its fittings. The *Thunderer's* guns will be exhaustively tested at sea as soon as her steam trials have been carried out.

THE TRANSATLANTIC STEAMSHIP TRAFFIC.—A Dalziel cable message from Queenstown says that it has now been definitely arranged that next year the *Teutonic*, *City of New York*, *Majestic*, and *City of Paris*, which latter will go on her station in April, will be run on different dates, making together a weekly service such as cannot be excelled in the world, since they are all 20-knot boats, and all come within a few minutes of each other in the duration of the now very fast Transatlantic trip—about 5 days 20 hours. The arrangement is not due to any specific agreement, but because there is a feeling that it is wiser to do this than to let a fast ship of each line sail on the same days and at the same hours. It will get rid of the idea that because they left contemporaneously the officers of necessity were prepared to risk anything for the sake of a race; but the greater advantage is that the travelling public will have greater scope in choosing a date on which they can get a fast and thoroughly comfortable Transatlantic steamer.

SHIP CAISSONS.

At a meeting of the Society of Engineers, held at the Town Hall, Westminster, Mr. Henry Adams, president, in the chair, a paper was read by Mr. J. J. F. Andrews, M.A., on "Ship Caissons for Dock Basins and Dry Docks." The author prefaced his paper by a general review of ship caissons generally in use for dock basins and dry docks, and pointed out the progress of caisson construction from the early caissons closing entrances of from 40 ft. to 50 ft. openings, and 20 ft. of water over sill, to those now in use, in some of her Majesty's and other dockyards, closing entrances of from 90 ft. to 95 ft., and having water over the sill of some 36 ft. to 38 ft., and a depth from sill to coping of 40 ft. to 45 ft. He then reviewed the improvements and alterations in design as to construction, methods of working, from the caisson floating with the bottom buoyancy, and sinking by water admitted to the bottom or interior of the caisson (the water so admitted being pumped out or run into the dock when raising), to the caissons with water-tight decks, forming an air chamber, and having a top tank to contain water for sinking. He then reviewed the question of stability under different conditions of construction as to quantity of ballast required for safe working, and the conditions of flotation as regards positions of metacentre, centre of gravity, and centre of buoyancy of flotation, and stated generally that for a caisson floating with bottom buoyancy the common centre of gravity of caisson, ballast, and all the weights should be at the same determinate distance below the metacentre, and, with the caisson floating with air chamber, the common centre of gravity of cassion, ballast, and all the weights should be from between 1 foot and 2 ft. below the centre of flotation of air chamber, and all the parts immersed. The author explained the relative values of six different types of caissons, as to design, construction, method of working, stability of flotation, use, &c., and called special attention to types of caissons of large size that have been constructed for her Majesty's dockyards at Chatham and Portsmouth, floating with air chamber at centre of caisson, and having "Seely's pigs" as ballast for steadying purposes in raising and sinking; also to a caisson built for the London and North-Western Railway Co. for their dock at Holyhead, having two distinct systems of flotation, *i.e.*, one with entire bottom buoyancy and stability, with metacentre for floating at extremely light draught of water, and the other for flotation at a deeper draught for working in high tides and strong wind, with air chamber and top water tank, ballast being contained in the lower portion, formed of clinker set in cement. He then stated incidentally, that in launching some large caissons, some were constructed 94 ft. long and 43 ft. deep, and launched sideways down the ways, the top of caisson being some 50 ft. or 60 ft. above the ground, and having a distance to travel before reaching the water of some 100 ft. to 200 ft., and when in the water, having a draught of about 18 ft., with a metacentre of flotation of only about a foot above the common centre of gravity of weight and ballast, this result being obtained by the use of a considerable quantity of pig-iron ballast stowed low down in the bottom of the caisson. He concluded by describing an ingenious contrivance for taking the contour or invert of dock and basin entrances, whether either wholly or partially covered with water, and instanced certain past and recent peculiarities of design as carried out in the Limekiln and Barry Docks.

New Line of Steamers.—It is reported that negotiations are in progress between Mr. Melville Ingalls, president of the Chesapeake and Ohio Railway Co., and Mr. Bruce Ismay with a view to the establishment of a direct line of steamers between Newport News and Liverpool. Mr. Ingalls has been long anxious to make a direct outlet from the terminus of the railroad at Newport News for the vast quantities of grain which the road draws from the tributary country, and which are now either diverted to other roads and carried to New York overland or are conveyed thither by ships. Mr. Ingalls believes that Newport News can be made an export outlet for the whole of the south, at the same time drawing traffic from the territory traversed by the Big Four system. It is reported that Mr. Ismay will recommend the White Star Co. to start this line of steamers, as he believes that they will obtain passengers as well as freight. The piers, land, and terminal facilities at Newport News are owned by Mr. C. P. Huntington, the millionaire, who kept them when he sold his controlling interest in the railroad.

LAUNCH OF THE PROTECTED SECOND-CLASS TWIN-SCREW CRUISER "PIQUE."

On Saturday afternoon, December 13th, there was launched from the Howdon-on-Tyne yard of Sir C. M. Palmer's Shipbuilding and Iron Co., Limited, her Majesty's cruiser *Pique*.

The *Pique* is one of the protected second-class twin-screw cruisers provided for by the Naval Defence Act of last year, and is the first of three of the same class that Palmer & Co. are at present building for her Majesty's Government. Her dimensions are as follows:—Length between perpendiculars, 300 ft.; breadth extreme, 43 ft. 8 in.; depth moulded, 22 ft. 9 in.; displacement, 3,600 tons on a mean draft of 17 ft. 6 in.; I.H.P., 9,000; speed, 20 knots. The vessel has two funnels and two pole masts, with a light fore and aft rig. The hull throughout is built of steel, and the bottom of the ship is sheathed with teak 3½ in. in thickness to 2 ft. above the water-line. The stem, sternpost, rudder, and shaft brackets are of phosphor bronze. There is a steel protective deck, which extends the whole length of the vessel. The transverse section of this deck is in the form of a flat arch, the crown of which rises 1 ft. above the water-line at centre of vessel, and slopes down towards the sides to a point 4 ft. below the load-line. The thickness on the sloping part is 2 in. and 1 in. on the crown, where are placed under the protective deck the engines and boilers, magazines, steering gear, and other vital parts of the ship. Vertical engines are adopted in the *Pique*, and, in order to insure protection to the cylinders which project above the protective deck, a belt of armour of solid steel 5 in. in thickness, with 7 in. of teak backing, is fitted round the engine hatchways, between the protective and upper decks. The vessel is divided into a large number of water-tight compartments, and has a double bottom the full extent of engine and boiler space, the continuity of which is carried forward and aft by the water-tight flats forming the magazines, shell rooms, and store rooms of the ship. The bunkers are placed alongside the engines and boilers, and extend to the upper deck. There are two separate engine and boiler rooms.

The armament consists of two 6 in. breechloading guns, one mounted on the poop and the other on the forecastle, both placed on the middle line; six 4·7 in. quick-firing guns, three on each broadside; eight six-pounder quick-firing guns, one three-pounder gun, and four five-barrel Nordenfeldt guns mounted on suitable stations along the sides of the vessel. A nine-pounder gun for boat and field purposes is also secured on deck. In addition to this, four torpedo tubes are fitted—one forward, one aft, and one on each broadside. For controlling the ship in action a conning tower of steel 3 in. thick is fitted on the aft end of the forecastle, inside of which the various telegraph instruments, steering wheel, voice pipes, &c., are placed.

A complete installation of electric light is fitted, including three powerful search lights. The crew numbers 250 hands all told. The propelling machinery consists of two sets of vertical triple expansion engines, having cylinders 33½ in., 49 in., 74 in., and 39 in. stroke. The boilers are five in number. The close stoke-hole system of forced draught is introduced, each stoke-hole being fitted with two powerful fans worked by separate engines for the supply of air. The coal supply on 17 ft. 6 in. draft is 400 tons.

The religious service was conducted by the Rev. Mr. Hughes, of Howdon, and the christening ceremony was performed by Miss Dale, daughter of Alderman Dale, a director of the Palmer Company.

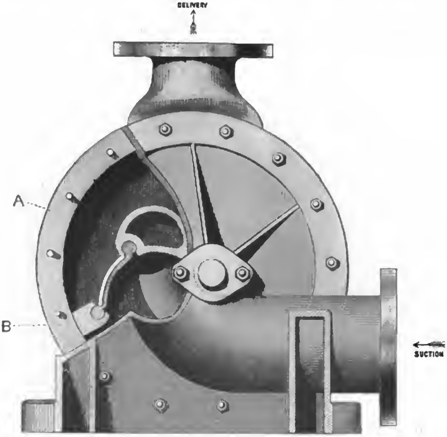
The next meetings of the Institution of Naval Architects will fall unusually early, viz., on March 18th, 19th, and 20th, 1891.

The London, Woolwich and Clacton-on-Sea Steamboat Co. have placed an order with Messrs. Denny Bros., of Dumbarton, for a steel paddle passenger boat like the *Clacton Belle*. She will be delivered in May, 1891.

A Brazilian Exhibition.—Brazil has decided to have a world's fair, to open in November, 1892. The exhibition is under the direct patronage and support of the Brazilian Government. It will take place at Rio de Janeiro.

ODDIE'S PATENT COMBINED CENTRIFUGAL AND POSITIVE ACTION PUMPS.

WE had an opportunity recently of seeing this pump in operation at the Britannia Works, Larkhall Lane, Clapham, and then formed a high opinion of its capabilities. The drawings we give represent the pump to a scale of one-eighth full size. This pump is capable of throwing from 20,000 to 40,000 gallons per hour at about 80 to 170 revolutions per minute respectively. The arrangements are very simple. It will be seen from figure 2 that the water is drawn in at the centre and discharged at the periphery—quite a new arrangement with positive action pumps. The inside consists of an impeller or disc A running on spindle C, with blades B, formed nearly the same as in an ordinary centrifugal pump. The inlet and outlet ports are however so arranged with regard to disc and blades that at no time is there direct communication between the suction and delivery, thus obtaining a positive discharge every revolution, combined with the advantages of a centrifugal pump.

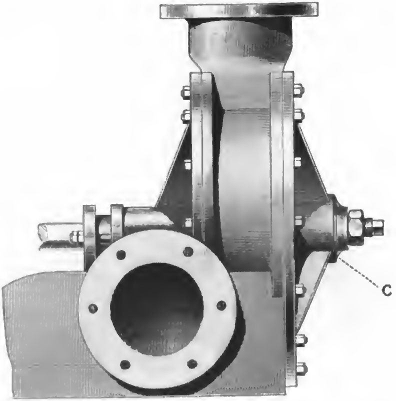


The chief features of the invention are the arrangement and working of the segment plates and blades. In the pump we are describing there are three segments and three blades. These form the impeller which, as we have said, turns on the spindle C, and work eccentrically. The segments fit into a boss at C, and are surrounded by an outside ring, in which they revolve, and are held in position. The blades being inserted into the segment plate, relieve the periphery of the cylinder of all pressure, and at the same time open and close the suction port three times with each revolution, and of course the delivery port is opened and closed a like number of times, and thus a steady and constant throw of water is obtained.

The absence of valves and the large clearance space allow of dirt, shavings, chips, cotton waste, coals, &c., being passed through the pump without injury, and on our visit of inspection we saw the pump kept working while drawing in air with the water at varying speeds, and it practically passed anything through it that would be able to pass out at the delivery port at the periphery. These great advantages make this an invaluable bilge pump, its large powers of suction and lift, and the small space it occupies make it most efficient for all ships' purposes. The water can be raised from a depth of 27 feet below the spindle C of the pump without the use of a foot valve, and at a comparatively low speed, and they can be constructed to force water to a height of 300 feet, and we can strongly recommend them to shipbuilders and ship owners.

The following are some of the additional advantages claimed for this pump:—

The water enters the pump without shock, being aided by the centrifugal force generated by the water in the pump. N.B.—The reverse is the case in ordinary rotary pumps, they having to draw their water against centrifugal force. The speed being about one-fourth of that required for ordinary centrifugal pumps, it can be driven direct by any engine, the necessity for high-speed engines, multiple gear, &c., which absorb much power and cause great wear and tear, being dispensed with. Experiments made to ascertain percentage of work obtained from above pump, show an efficiency of upwards of 60 per cent. on total lift of 18 feet, the suction lift being about 13 feet. This efficiency is far higher than that of a simple centrifugal pump under like conditions. The construction of the pump is very simple, it is very strong, and almost impossible to choke or put out of order, there being no valves, springs, joint pins, &c. The total amount of friction, wear and tear, is little more than that of a shaft in an ordinary bearing, there being no pressure on the inner periphery or sides of the pump. In price it will compare most favourably with any pump in the market.



THE HULL AND DISTRICT INSTITUTION OF ENGINEERS AND NAVAL ARCHITECTS.

THE first ordinary meeting of the sixth session of the above institution was held on November 25th, at the rooms, Parochial Office, Bond Street, Hull, C. F. Amos, Esq., the President, in the chair.

After the usual business, including the reading of the Treasurer's report for the past year (which was pronounced to be eminently satisfactory, there being a substantial balance at the bank), the President opened a discussion on "The Education of Engineers," and in the course of his remarks, dwelt at some length on the work which was done in 1887 by the "Hull Council for Promoting Technical Education." He also gave a lucid explanation of the recent Parliamentary Acts on Technical Instruction, and the course of study recommended to engineers and others by the Council of the Manchester Association of Engineers, giving some interesting illustrations of the difficulties engineering students laboured under in the way of book learning. The discussion was ably taken up by A. E. aton, Esq., C.E. (of Earle's Shipbuilding and Engineering Ld), who gave further particulars of the doings of the Hull Technical Council, and also described the various higher grade technical schools that he and other members of the Hull School Board had recently visited in Sheffield, Leeds, and elsewhere, with a view to adopting the successful features thereof in the new Higher Grade School now in course of construction.

Mr. A. N. Somerscales gave a description of the foundation and rise of the Hull Young People's Christian and Literary Institute, and gave proof of the good work it had done in forwarding education of a technical character, and he also gave some information as to what is being done in the Public Elementary Board Schools at the present time, and pointed out several faults in regard to the character of the training given to the rising generation, which he (Mr. Somerscales) thought was only suited to the children of a "nation of shopkeepers," particularly in respect to the system of arithmetic at present taught.

Owing to the lengthy discussion, and to the fact that a large number of the members had promised to give their views on the subject, it was decided to adjourn the meeting.

The second ordinary meeting of the Hull and District Institution of Engineers and Naval Architects took place on Tuesday evening, December 9th, C. F. Amos, Esq., in the chair.

The discussion on "The Education of Engineers," which had been adjourned from the meeting of the 25th ult., was resumed by Mr. A. N. Somerscales, who in the course of his remarks, deplored the elementary character of science teaching generally, but also pointed out that Hull was no worse than many other towns in this respect. The list of honour students for the present year shows Hull to stand higher than Liverpool, Edinboro', Nottingham, Sheffield, and many other educational centres. He, Mr. Somerscales, advocated technical mental training rather than the mere acquiring of information, which, he argued, might be quite useless to an engineer if unaccompanied by habits of observation and reflection.

Mr. J. R. Smith, who followed him, gave some interesting facts concerning the methods which several engineering firms had adopted of educating their apprentices, and of recruiting their drawing-office staff from such of these who gave promise of good ability. He was ably followed by Mr. T. Thompson, who deprecated the principle of teaching too much theory to artisan students, and argued that instruction in such subjects as drawing, practical geometry, and mensuration, would be of much service to such students.

Mr. J. Brackenbury thought that the present system of payments by results, as carried out by the Science and Art Department, was not an efficient one, as it involved a close adherence to the syllabus laid down by them, thus preventing the teacher from striking out in an original line of his own.

Mr. A. H. Tyacke gave some particulars of the system which Mr. A. E. Seaton had introduced into Earle's Company, viz., the giving of short lectures during working hours to the engineering students at that establishment.

His remarks on this subject were supplemented by Mr. F. H. Pearson (Earle's Co.), and the discussion was sustained by Messrs. R. Murray, James Innes, — Stromeyer, M. Stirling, and L. Simpson.

The President then replied to the remarks which had been made by the several members, and the proceedings terminated by a vote of thanks to Mr. C. F. Amos for the able manner in which he had introduced the subject for discussion.

THE DIVERSION OF TRAFFIC AND THE DISPLACEMENT OF LABOUR BY ARTIFICIAL NAVIGATION.

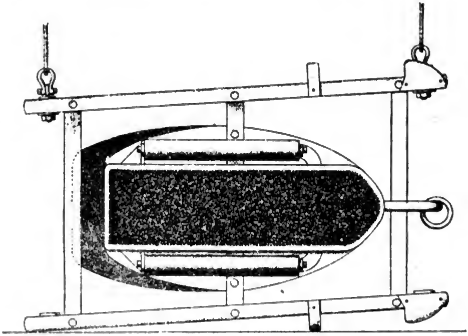
THERE is probably no country on the face of the earth whose physical formation provides all that is essential to a perfect system of water transport. The geographical features which have been created for natural uses prove themselves obstacles when industry seeks to extend her regions. Yet, on the other hand, it is the presence of these superficial inequalities which have been and are the primal source of the greatest of engineering undertakings and successes. By their absence the engineer would, to a great extent, be deprived of that which furnishes him with the *raison d'etre* of his profession. Thus the equilibrium is restored between nature and industry, and the latter is by the hindrances which the former presents stimulated by the construction of the means, through which industry will enter, and by the introduction of trade and the establishment of fresh labour markets in previously untouched districts. This principle is instanced in the erection of bridges, the building of subterranean connections, canals, railways, which form the *media* whereby towns and districts once remote are brought into closer proximity to the centres of labour, and which also stimulate manufactures and industry directly by their construction, *per se*, Distance and time, in the present age, likewise, are deterrents from activity, and wherever these exist as preventions, there will be the need for their reduction to a minimum. Competition's ambition is the attainment of the possible minimum, and wherever industrialism is to any extent developed, this force enters in as a potent factor in the regulation of the market. To this end there have been applied no machinery so effective as that of transport by railway and by water, but of the two items that enter into the systems of transportation, cheapness and speed, the latter up to the present time has attained supremacy. Manufacturers and producers choose, in preference, quick delivery and a trifling excess in carriage to cheap rates and slower removal. Evidences of this are too numerous to mention, but the fact is demonstrated in the traffic returns of the railway companies as against those of the canal companies. There are, however, circumstances connected with the transport of commodities that are beyond the scope of railway companies to contend with, and for the consideration of this subject we turn for a brief review of the diversion of traffic by artificial navigation. We have stated that where there is pressing need for the adoption of greater facilities for the transference of commodities from one part of the world to the other, and where the introduction of these requirements, be they the canalization of rivers, or the construction of special canals, is not carried out, that country will be fostering a suicidal policy to the prosperity of her future trade. Improvements, in this respect, do not and cannot banish trade, but increase, though probably divert it. In the Ship Canal, now in progress at Manchester, we have a true example of what will be the diversion of traffic, and yet by that very change, trade undoubtedly will be increased. Now such an innovation to the existing method implies, on analysis, several important facts: That the prevailing condition of things is recognised as insufficient for the purpose; that the means by which the traffic is regulated and conveyed will suffer injury by its diversion; that the money expended upon its transference will be likewise removed to the parts where the traffic goes; that the prices of the special items of production or manufacture will be reduced; and that the trade at the one place will be diminished and at the other place increased, by the quantity of goods handled. It also will afford additional labour in the matter of repairing at various times the constructions used. The only methods now by which goods can be transported to Manchester from Liverpool are by two canals and five railways. The condition and government of these waterways preclude the possibility of the ascent of any large vessels, as they are practically in the hands of the railway companies, and not likely to be placed in such a position as would make them at all able to compete with the railway rates. Such is the *vera causa* of the need for further facilities for carrying the traffic to Manchester, and this fact will mean a great diversion of the traffic of Liverpool. Instead of vessels, whose burdens are imports from the Americas, docking at Liverpool, and the goods being forwarded *via* railroad, to Manchester, they will pass up the canal direct to the city. Thus we have removal of traffic from Liverpool to Manchester, and the importations to the former place will be reduced by that amount by which the latter will be augmented—naturally, concurrently with this movement, there will be a decrease in the employment of labour at Liverpool with similar increase at Manchester; for the ships that were loaded and unloaded, and the railway trucks that were freighted and disburdened, at the former town will be treated with at the latter. We cannot overlook the fact that this will make a considerable difference to the dock, as well as to the railway companies. An import trade to a town of over £100,000,000 sterling, or nearly four million tons, out of which nearly two million tons are transmitted by rail to one some distance off, when prohibited, certainly must be interpreted as a loss. When we discover that there exists an exportage of cotton manufactures amounting to nearly £500,000 yearly through Liverpool, the great proportion of which is derived from in and around Manchester, undeniably when that vast amount of traffic gives the go-by to the Liverpool docks and railways, it is not a small matter. And this diversion of traffic will run parallel to a proportionate displacement of labour, and an increase in consumption of commodities, wherever that labour is removed to. It is almost a difficulty to define the limits of such changes. Traffic, labour, consumption—all are altered in their accustomed courses: wherever traffic is there we shall find labour. The one precedes the other, and it is remarkable to observe how silently these great variations take place. The handling of 2,000,000 tons of goods means the employment of a great number of labourers, and affords the opportunity of soaking up some fraction of the vast floating unemployed labour. Let us look also for a short time at the effect of the Suez Canal. The movement in this case is of somewhat a different character to that with which we have just been dealing. Previous to the completion of this undertaking, ships desirous of reaching the far East, either were compelled to round Cape of Good Hope, or, travelling westward, to sail round Cape Horn. This incurred a very great loss of time and a large consumption of fuel. Since 1870, however—the date when the Suez Canal was opened for traffic—London and Canton have been brought 3,300 miles nearer to one another; between London and Bombay there has been a reduction of 4,325 miles, and between London and Calcutta a diminution of 3,626 miles. In this diversion also other ports have become more active, and the districts which had been previously shunned were brought into contact with enterprise and industry. The diversion of traffic by these waterways, as the railways, have had a good deal to do with the opening up of and civilizing, countries. We have only to glance at a few figures to realise this. In 1865, or nearly five years previous to the opening of the Suez Canal, the value of the imports from Australia was £10,273,000, while in 1870 and 1871 they were in excess of £14,000,000, and the exports to Australia from our country were in 1865 to the value of £14,000,000, and in 1872 over £15,000,000 sterling. China increased her exports to the United Kingdom from 3¾ millions sterling in 1865 to over 6¾ millions in 1871. The total tonnage that passed through the canal in 1870 was 654,900, in 1871 a little over a million; in 1882 it had increased to five millions, and in 1889 to nearly seven millions. This proves how great has been the influence of the transportation facilities offered by the Suez Canal to the development of the world's trade. This enormous addition could not have taken place had the Isthmus of Suez remained untouched, for distance has always acted as a preventive to progression and extension in this respect.

The other instance that we would mention as bearing upon our subject is that of the Nicaraguan Canal now being constructed. The effect of this canal will be to increase the trade of Western America and China. Although the distance between Europe and the East, *viâ* Suez, has been greatly lessened, yet an improvement in this accessibility is bound to tell on the industrial relationship between Europe and the far East. From the ports on the American Pacific coast we receive very large supplies of wheat-meal and flour. This is a commodity which is one of our essential importations, and as time goes on the demand is certain to become much greater. At the present time this grain is transported *viâ* railroad across country to the Atlantic seaboard and shipped. But the canal will bring us some 3,000 miles nearer, and the grain and other produce will be brought straight away from the Pacific ports to England without the aid of the railways. The trade between central America and the States will be carried on through the canal, and a saving of time and of labour will be effected. To us, New Zealand, one of our supporters in grain, meat, dairy produce, &c., will be 1,500 miles closer, so that vessels can travel eastward from that country *viâ* the canal, and arrive at England in a much reduced time. Then also, the labour which has been connected with the railroads to deal with this traffic will be called to the Pacific ports to laden their vessels for Europe, and these ports will become the centres of great and growing activity, while customers in the East will be enabled to receive their cargoes cheaper and quicker than heretofore. This will tend to increase labour in one place and decrease it in others, whilst probably the prices of wheat and flour will be imported at a cheaper rate than previously. Other and numerous instances might be quoted to uphold these facts, for the canals in Canada, the United States, Greece, and in many other countries have produced these results in a greater or less degree.

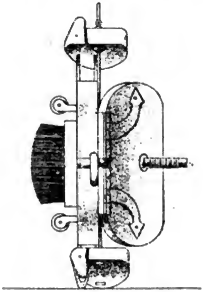
The Phosphor Bronze Company, Limited, of 87, Sumner Street, Southwark, London, Litherland, Liverpool, and Salem Street, Etruria, announce that they have appointed as their manager of their rolling and wire mills, Birmingham, Mr. W. A. Perry, recently the manager of Messrs. H. H. Vivian & Co., Lim, Birmingham and London. They are largely increasing their business in patent bronze wire for electrical purposes; also phosphor bronze rods and sheets for marine use, &c.

SPIERS' PATENT SHIP-CLEANING APPLIANCES.

THE bottoms of iron ships and steamers become so foul that they require to be docked every six to twelve months if they are to be kept going at full speed. Take the case of an ironclad whose bottom is foul and it will be found that its efficiency is something like 30 per cent. less than one whose bottom is clean. Of course, merchant steamers are the same way affected. As we have not got docks in half our foreign stations capable of taking in a large ironclad, the importance of Mr. Spiers' appliance for cleaning ships' bottoms while at sea cannot be overestimated. The appliance is almost self-acting, being propelled by the action of the vessel passing through the water. The crude idea is not novel, but the patented improvements worked out on the machine, and brought into conjunction with the patent tackle, so perfect the appliance as to enable it to travel from water-line to keel, where it reverses and comes up over the same sweep as it went down, cleaning the vessel thoroughly without injury to her paint. The brush is held to the side of the vessel by the pressure of the water acting on a movable fan, which is adjusted to the various speeds of the vessel. The patent shoe or clamp on the cutwater gives the centre from which the appliance is worked, and is easily adjusted and certain. The patent steel tackle can work over the whole length of a ship, with its friction on the paint being reduced to *nil*. This tackle enables any vessel to be perfectly cleaned in the run and the flat of the bottom. The brush is the only part of the appliance touching the plates, and the utmost care has been taken in arriving at a material sufficient to remove grass and small shells without the slightest injury to the paint. Barnacles and other incrustations over half-an-inch in length are struck off by the rollers. So the heavy cleaning is


FRONT VIEW OF APPLIANCE.

actually effected by a means which is so arranged that it can never touch the skin of the ship—no scraper of any description being employed. Sailing vessels can be cleaned from cut-water to stern-post; steamers aft to within 15 or 20 feet of their propellers. The breaking-strain of the steel rope tackle provided for sailing ships is several hundred per cent. over the actual strain required. The tackle provided for steamers is materially heavier, and with them additional precautions are taken—such as reducing speed for the few hours required for cleaning. Expensive docking abroad can now be avoided, as ships can have within themselves a reliable and self-acting cleaning power. No vessel need make a long passage through foulness. The importance of the improved inventions to steamers is very considerable, as they can now continue at sea for several long voyages and still maintain their average speed with their original minimum consumpt of coal, securing thereby an increase of speed, a saving of coal, and a consequently greater carrying space.



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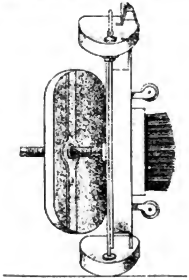


Back End

The firm of Alexr. D. Spiers & Co., the patentees, have offices at 6, Crosby Square, London, where working models can always be seen, as well as some interesting photographs of cleaning work done at sea for the Admiralty on some of H.M. Ships.

Considerably over half a million tons of shipping have been supplied with these patents during the past five years.

NAVAL NOTES.

Warship Construction at Devonport.

WITH regard to the completion of vessels already launched, and those arranged to be built, the ensuing financial year promises to be one of continued activity in the dockyard at Devonport. Since the launch of the first-class cruiser *Edgar*, which took place in November last, the Admiralty have issued orders for the construction of two new vessels, to be named the *Hermione* and *Halcyon* respectively. It is to be regretted that the authorities at head-quarters could not see their way clear to entrust the constructive department at Devonport with something of a more substantial character, from a tonnage standpoint, than that of a second-class cruiser, and thereby enable the officials to utilise to the best advantage the additional resources—in the way of new plant—which have recently been added to the "New Ground" part of the establishment. The more especially is this to be regretted when the creditable, rapid, and comparatively economical manner in which the *Edgar*, of 7,350 tons displacement, was put out of hand, is considered. The new second-class cruiser, *Hermione*, which will be commenced forthwith, is one of the enlarged *Medea* class, and is intended to be of the following dimensions:—Length between perpendiculars, 300 ft.; breadth, extreme, 43·7 ft.; and mean draught of water, 17·5 ft., with a displacement at this draught of 3,600 tons. She will be of the protective-deck type, and built of steel throughout, while her bottom will be sheathed with wood. The estimated I.H.P. is 9,000, with forced draught, and the speed 19·5 knots.

The *Halcyon* is a much smaller vessel, and one of a class popularly known as torpedo-boat catchers, but officially designated first-class torpedo gunboats. In dimensions and construction of hull she will be practically the same as the *Sharpshooter*, recently completed at Devonport, but certain modifications and improvements will be embodied in her machinery. She will be 230 ft. in length between perpendiculars; 27 ft. in extreme breadth, with a mean draught of water of 8·2 ft., and a displacement of 735 tons. The bunker capacity is fixed at 100 tons, and the estimated speed is 21 knots, with a collective I.H.P. of 4,500.

In the slip vacated by the *Edgar*, the *Bonaventure*, a second-class cruiser of 3,400 tons has been commenced, and already large quantities of material have been placed in position on the blocks. She will measure 300 ft. in length by 43 ft. in extreme breadth, by 16·5 ft. main draught, and will be provided with a protective deck 2 in. thick on the slopes and 1 in. thick at the centre. Two sets of triple-expansion engines will be provided capable of developing upwards of 9,000 I.H.P., which is deemed sufficient to realize a speed of 20 knots. The armament she is intended to carry will be of the most powerful description, and will include two 6-in. breach-loading guns; six 36-pounder guns; nine 6-pounder guns; and three 3-pounder quick-firing guns; together with four torpedo tubes for the discharge of Whitehead torpedoes. The other vessels in course of construction are the first-class gunboat *Antelope*, and the second-class cruisers *Astræa* and *Æolus*. Rapid strides towards completion are being made with the latter vessel, and work on the *Antelope*, which has been for some time practically at a standstill, pending alterations and improvements, is now to receive additional attention, and to be vigorously pushed forward. Among vessels fitting out, the *Phœbe* and *Philomel* are nearing completion, and their engine trials, which will in all probability take place during March or April next, are being looked forward to by the engineering branch with more than the average amount of interest. Each of these vessels were built here, but while the engines of the *Philomel* have been supplied by Messrs. Earle & Co., of Hull, those of the *Phœbe* have been designed and manufactured by the engineering department of the dockyard, hence the interest centred in these vessels. They are provided with two sets of triple-expansion engines capable of developing 7,500 H.P., the estimated speed being 19 knots.

The fitting out of the *Edgar* will be advanced to almost the finished stage during the year, and the work enumerated, together with the customary repairs to commissioned ships attached to this port, is likely to keep matters busy till the end of 1891.

"H.M.S. RATTLER."

The China squadron of British warships was recently caught in a severe gale which considerably damaged some of the vessels, while the composite gun-vessel *Rattler* seems to have weathered the storm in a highly creditable manner, and without accident. It is stated that she was so skilfully handled as to cause the Admiral to signal to her commander the words "Well done." The *Rattler* is a sister vessel to the ill-fated *Wasp*, which was lost with all hands about two years ago between Singapore and Hong Kong—and about which so much of a condemnatory character was written at the time. The *Rattler* and *Wasp* were built for the Government by Messrs. Sir William Armstrong, Mitchell & Co., Newcastle-on-Tyne, to replace the obsolete vessels of the *Ready* class, and were completed at Sheerness Dockyard. The *Rattler* is unarmoured, but the vitals are protected by a steel deck and shot proof gratings. She is of 670 tons displacement, is fitted with engines of 1,000 H.P. and carries six 4-inch breech-loading guns on Vavasseur fittings, and provided with heavy shields for the protection of the gunners. The mounting of heavy guns on sponson ports in such small vessels has been condemned by many naval authorities, as they consider the risk in the event of the vessel encountering heavy seas is thereby increased. Not a few attribute the loss of the *Wasp* solely to this system of carrying the guns. It is however satisfactory to learn that the *Rattler* has successfully passed through a very trying test of her seaworthiness, a circumstance which will no doubt raise her and her sister ships, the *Lizard* and *Bramble*, in the estimation of naval commanders generally.

THE LAUNCHING OF NEW VESSELS.

There has been such a serious delay in the delivery of material from the contractors for some of the vessels under construction in the Royal dockyards, that the original intentions of the Admiralty authorities with regard to the dates of launching have had to be seriously modified. The greater part of this delay is traceable to labour difficulties, although in some instances the proper quantities of material have not been delivered at the right time for reasons best known to the contractors themselves. The *Centaur* first-class cruiser, which was originally intended to have been launched from Portsmouth early in November last, is now set down to leave her slipway in February next. The launch of the first-class battleship *Royal Sovereign* is also fixed to take place at Portsmouth during the same month, while the *Apollo*, second-class cruiser, which was to have been launched at Chatham some weeks ago, will not be put into the water for some time to come. The second-class cruisers, *Thetis* and *Pique*, each 300 ft. in length, with 9,000 I.H.P., were launched on the Clyde and Tyne respectively during December, the former by Messrs. J. & G. Thomson, Clydebank, and the latter by Messrs. Palmer & Co., Jarrow.

ENGINE-BUILDING AT PORTSMOUTH.

In pursuance of the policy to extend the construction of engines to the royal dockyards noticed in our November issue, the Admiralty have given the order for the designing and making of the engines of one of the second-class cruisers to Portsmouth, instead of giving it out to contract. This is the first order for new propelling engines entrusted to Portsmouth, to which establishment a special staff of engineers has recently been appointed. The *Gossamer* and *Gleaner* torpedo gunboats, the first fitted with engines at a Government works, are completed, or almost so, at Sheerness, and have been ordered out for trial. Much interest is attached to the trial, and the vessels will make a series of runs at progressive speeds to thoroughly test the efficiency of the engines. They are designed to indicate 2,500 H.P. with natural draught, giving a speed of about 19 knots, and with fan draught during closed stokeholes the power is to be 4,500, and the speed of the vessel 21 knots.

THE COOPER AND WIGZELL SEA-SOUNDING INSTRUMENT.

MANY ingenious devices have from time to time been introduced for taking soundings at sea. The rotating screw or propeller sounder was a distinct advance on the old lead and line, but tide and leeway affected the indication of this instrument greatly, as the sinker adopted a circuitous course; the blades of the screw were also very liable to become entangled, or have their pitch altered by a blow. In fact this plan has nearly died out entirely. The water kite plan has also been attempted, if we may judge from the records in the patent office. This is not however a measurer of depth, it is merely intended to serve as an alarm in shallow water and at low speeds, and cannot take the place of a proper sea-sounding instrument.

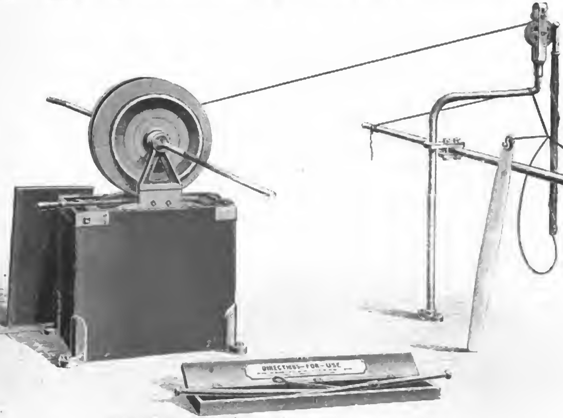
The next style of sounder to come forward was the atmospheric sounding instrument, and many attempts have been made since Mr. Ericson made his river measuring instrument, which was ahead of its time. As these instruments depend altogether on the volume of air contained before lowering into the water, and this depends upon the temperature of that volume, the shrinkage caused by the instrument passing through a stratum of cold water would amount under some circumstances to 20 fathoms of error.

A great difficulty in all sounding instruments is to secure a definite and unmistakable record of the depth attained, and one which will not alter after being obtained through shock or concussion, and the violent slashing of the waves when the sounder is being hove in.

In one air instrument made, the water which has entered, and which should remain for a record, is at liberty to shake out again on its passage through the water when being hauled in. Air is too elastic and too easily affected by pressure to allow any reliance to be placed upon it. One can never say whether a given volume has expanded or has been partially absorbed by the pressure of a column of non-aerated water. Another plan for an air instrument is to colour tubes with a chemical, or otherwise, and the water leaves a washed-off space as it were, which is measured on a scale, and is supposed to furnish an indication of the depth to which the instrument descended. What occurs is that the tube during its journey down and back takes up a more or less horizontal position, and the violent shaking of the waves splashes the water longitudinally inside the tube, and thus no definite mark is perceptible. The depth can then be read off to suit the taste or preconceived notion of the navigator, so that this plan has its friends. The working expense through loss and the cost of re-colouring tubes is such a serious item of expenditure that this plan of sounder must eventually give place to a less troublesome and costly method. All these instruments in smooth water and favorable circumstances can be made to approach the truth, but it is in actual sea practice that they fail, and in these coming days of more accurate navigation they must give place to better instruments.

Sounding as properly understood is to enable the navigator to find his position and proceed on his voyage. A captain is usually engaged navigating his vessel, and it is no part of his duty to see how near the coast he can run without suffering a shipwreck; what he requires is his position, and this in thick weather can only be had by knowing his exact depth of water at certain times and places.

The Government spends a great amount of money annually in accurately surveying the ocean in all parts of the world. A chart as we know it in modern days, with every detail of land, with every rock and shoal, with every depth of water, accurately marked at regular and small distances, is a credit to human ingenuity, and a testimony of man's intelligence. By the use of the depths, or soundings, marked on these charts, the navigator, without sun or stars, in storm or fog, can safely proceed on his voyage, or guide his ship into the required haven. It is only necessary that he shall possess a really trustworthy sounding machine and use it. In past times faulty instruments were common, and this accounts for the still too frequent stranding through neglect of the lead; it fell into disrepute. There is no excuse for this now, however, and considering the great importance of this matter of sea-sounding (and continued neglect of it) it is almost time the law stepped in with penalties, so as to protect life from the over-confident and easy-going master.



Messrs. Cooper & Wigzell's new patent Sea Sounder seems to overcome the difficulties that have hitherto been experienced and gives all that is wanted. This sounder has been thoroughly tested on board steamers belonging to the Orient Steam Navigation Co., the Pacific Steam Navigation Co., the Clare Line, the Chilian Navy, the Russian Navy, the British Shipowners' Association, the China Navigation Co., the Glen Line, the Honourable Corporation of Trinity House, &c., &c., &c., and also on board H.M. Surveying Ship *Research*.

We are not aware that the International Maritime Conference that sat at Washington recently made any suggestion in regard to sounding at sea, either as to the necessity of it, or as to what method was most satisfactory. No doubt there will be legislation on the matter soon, and on this account the fittest apparatus for modern steamships should be decided. This should be done altogether in regard to the merits of the instruments, as it is really a question of safety of life and property. It is interesting to note that Messrs. Cooper & Wigzell are confident enough to challenge all comers to produce a cheaper apparatus consistent with efficiency, or one which can be more conveniently used and show such extreme accuracy.

TRI-COMPOUND STEEPLE ENGINES.

THE 'VIOLET.'

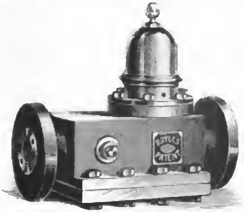
A FEATURE in modern marine engineering is the resuscitation of many ideas and designs that were well-known to the past generation of engineers, but which have lapsed and become temporarily obsolete, owing to the fact that these ideas were usually in advance of the times; for instance, the compound engine was known and used fully half-a-century ago, yet its universal use for marine purposes may be said to date from the "sixties." The tri-compound engine was designed and constructed in 1872 by Mr. Ferguson, of the well-known firm of Fleming & Ferguson, of Paisley, but it cannot be said to have become common or in general use till its merits were exemplified by the results obtained in Messrs. George Thompson & Co.'s steamer *Aberdeen*, in 1882. Among the early forms of the marine engine, that type known as the "Steeple" was evolved on the Clyde, and is still a favourite with many engineers. Its use has, however, been chiefly confined to river boats, tugs,

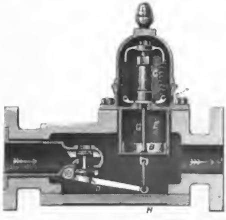
&c.; and we cannot recall to mind any ocean-going vessel that has within the last forty years been fitted with this kind of engine. In designing the machinery for fast paddle steamers, most engineers would, we think, consider the respective merits of the diagonal and oscillating types. Few, we think, would be rash or bold enough to revert to what is generally thought to be an obsolete type; yet inasmuch as the genius of the engineer is shown in adapting his machinery to given conditions, we think that it will be conceded that in fitting a set of tri-compound steeple engines to a very fast paddle-steamer, Messrs. Laird Brothers have shown at once a boldness in design, a disregard for conventional practice,and an amount of originality in execution only equalled by the success attained. The *Violet* is a paddle steamer built and engined by Messrs. Laird for the London and North Western Railway Co. in 1879, for their fast mail and passenger service between Holyhead and Dublin. She was put on her station in 1880. She is 298·5 ft. long on low-water-line, 33 ft. beam moulded, and 13 ft. 11¼ in. depth of hold. Her mean draft on her trial was 10 ft. 8 in. She was fitted with a pair of simple oscillating engines, the cylinders being 78 in. in diameter, with 7 ft. stroke, and the power they developed was 3,200 I.H.P. The boilers, four in number, supplied steam at 30 lbs. per square inch, the heating surface being 12,215 square feet, and the total grate area 480 square feet. On her trial trip, with the engines running at 28 revolutions, she attained a speed of 17·75 knots. Since then she has continued to run with regularity, and is known for her good passages. About two years ago the London and North Western Railway Co., finding it desirable to increase the speed of their Channel steamers, determined to re-engine and rebuild the *Violet*, and entrusted Messrs. Laird Brothers with the work. Very onerous conditions were laid down by the railway company. The chairman, Sir Richard Moon, through Admiral Dent, R.N., the marine superintendent, insisted that the new engines should occupy the same fore-and-aft space, the power was to be at least 30 per cent. more, and the existing passenger and cargo space was not in any way to be encroached upon, nor was the position of the paddle shaft to be altered. Having regard to the position of the centre of weight of the original machinery, and the position of the paddle shafting and boxes, it became a matter of impossibility to adopt either horizontal or diagonal engines. In short, length, breadth, and depth being fixed, the only direction in which any development was possible was in height. To put such a large power as was intended in the small length available rendered the adoption of the steeple engine imperative. So well has the design been worked out that the new engines develop 27 per cent. more power, while the weight of machinery is less by 25 per cent. than in the original engines. The new engines consist of a set of tri-compound steeple engines, the cylinders being 44, 70, and 108 in. in diameter, with a stroke of 6 ft. 6 in. The cylinders are bolted, without the intervention of any bedplate, to the engine-room keelsons by ordinary holding-down bolts, and secured to the entablature above by twelve wrought-iron columns, four to each cylinder. The cylinders are placed in line athwartships, the L.P. being in the middle, the H.P. on the port side, and the M.P. on the starboard side. The piston and piston rods are of steel, the H.P. and M.P. pistons being fitted with Ramsbottom rings and the L.P. with Peck's packing. There is one piston rod to the H.P. cylinder, and two each to the M.P. and L.P. cylinders. The piston rods carry three massive bowstring crosshead pieces. Each of these lower crossheads has two columns fitted inclined together and united at the upper ends by the upper crosshead, the whole forming a triangular framing or "harp. From the upper crosshead depends the connecting rods, also of steel. As will be gathered, the paddle shafting runs through these harps. The guides are supported by massive diagonal pieces springing from the entablature, and further secured by a system of stays and tie rods. Owing, too, to the small athwartship space, in which it was necessary to place three cranks in lieu of two, the valve chests had to be placed on the fore side and eccentric motion dispensed with. The type of valve gear adopted is Joy's, which is well known as possessing the good points of occupying little room and giving an earlier cut-off and better steam distribution. Piston valves are used for the H.P. and M.P. engines, and a balanced D slide for the L.P. engine. The reversing gear is attached to the upper framing which supports the guides, and is worked by Brown's steam and hydraulic engine. The crank pins, crank shafting, and paddle shafting are of hollow steel. All the bearings have a very large wearing surface. The condenser is placed in the fore-part of the engine-room, and is of the usual marine type. The circulating water is supplied to it by a centrifugal pump driven by one of Tangye's 16½-in. compound engines. The air pumps are of a special design. There is a vertical triple-compound engine, similar to those used on torpedo boats, placed immediately over the three air pump cylinders, and the pistons of the steam engines have a crosshead with forked arms which are united by a similar crosshead carrying the connecting rod, the arrangement being on the return connecting rod principle. The whole makes an exceedingly compact and smooth-running engine. The air pumps being placed below the condenser effectually drain it, and a vacuum of 28 in. is easily maintained. The main feed pumps are separate, and placed abaft the main engines. Each pump is capable of feeding all the boilers at full power. There are also auxiliary steam feed pumps in each stokehold, bilge and fire pumps. Steam is generated in six boilers of the loco-marine type, at a pressure of 150 lbs. on the square inch. These boilers are of steel, and are placed in two groups of three each, in two closed stokeholds. These boilers are similar to those fitted in torpedo boats: being of comparatively small diameter, they do not interfere with the main deck beams, which are not cut away. The boilers are lagged with fossil meal composition to retard radiation. The total heating surface in all the six boilers is 10,022 square feet, and the grate area 282 square feet. Air is supplied to the furnaces by two large fans situated on the upper deck, driven by two sets of Allan's compound vertical engines. The air pressure is 2½ in. of water. A donkey boiler is fitted in the after stokehold for use in port. There is also a complete electric light installation. The paddle-wheels have been reduced in diameter by 24 in., retaining, however, the same number and area of the floats as before. All the alterations and improvements have been made under the immediate supervision of Admiral Dent, R.N., marine superintendent, assisted by Mr. Beal. On Tuesday last the *Violet* left Liverpool and proceeded to Holyhead. There were on board Admiral Dent, representing the London and North Western Railway Co., Mr. John Laird, Mr. Bevis, and a large number of friends. The engines of the vessel were in charge of Mr. Ratsey Bevis. It was intended to make a test of the vessel's speed, but owing to the weather being thick this was not possible. It was, however, arranged that early next week a run should be made from Holyhead to Dublin. On Tuesday a devious course of 67 knots from the Rock Light to Holyhead Breakwater was covered in three hours forty-one minutes. Taking advantage of a brief spell of clear weather the engines were run at 36 revolutions, the steam pressure being 140 lbs., the I.H.P. 4,087, and the speed 19·3 knots. The contract specified 19 knots, with the idea that when necessary a speed of 20 knots would be obtained. From the preliminary performances there is no doubt whatever but that this speed will be reached. From the foregoing description it will be seen that the *Violet* is one of the fastest Channel boats we have. The way in which greater power, a higher speed, and a lessened coal consumption have been gained is highly creditable to all concerned.—*The Liverpool Journal of Commerce.*

Marine Engineering.—Mr. J. G. Lyon (of the firm of Messrs. Gourlay Brothers & Co., engineers and shipbuilders) delivered a lecture on marine engineering to the members of the Dundee Mechanical Society in the University College Hall last month. Mr. W. R. Lindsay, hon. vice-president, occupied the chair, and there was a large attendance. At the outset of his address, Mr. Lyon described the jet condensing engine which was in use 25 years ago and traced the various improvements until Samuel Hall introduced surface condensers, which had led up to the compound and triple-expansion type of the present day. Great improvements had likewise been effected in the construction of boilers. Formerly they were worked up to a pressure of 15 lbs. to 25 lbs. per square inch; now they were worked to 180 lbs., and tested to withstand a pressure of 360 lbs. Great economy had been effected in the consumption of fuel, which had been reduced from 6 lbs. and 7 lbs. per I.H.P. to a little over 1 lb. Referring to the engine-room fittings, Mr. Lyon spoke especially of the feed-water heater, by means of which water is put into the boilers at boiling point to the automatically-controlled feed-pumps and evaporators, and to the separate centrifugal circulating pumps. At the close a hearty vote of thanks was awarded to Mr. Lyon for his interesting address.

IMPROVED REDUCING VALVE FOR MARINE PURPOSES.

IN the days of high-pressure steam with pressures constantly tending to increase the importance of a good reducing valve cannot be overstated. This is especially the case for marine purposes, as the pressure usually carried in the boilers is too high for the winches and steering gear, and a reducing valve becomes a necessity. A large number of the well-known patent Royle reducing valves, manufactured by John J. Royle & Co. of the Dallam Works, Manchester, are already in use for this purpose, and the subject of the present notice is an improved arrangement of the parts specially for marine purposes to obtain greater compactness and efficiency at high pressures. The accompanying illustrations show pretty clearly the construction of this new reducing valve and the principle of action may be briefly described as follows:—A small escape valve (*c*), loaded to the reduced pressure desired, closes a cylinder (*e*) in which is a disc fitting loosely. Through a link and lever this controls the main valve (*a*) and owing to the slack fit of the disc it has a natural tendency to fall in the cylinder and open the main valve (*a*). The effect of this combination is that as soon as the reduced pressure is reached and the escape valve lifts and discharges rather more steam than the leakage between the disc and the cylinder, the former rises and closes the main valve (*a*) and adjusts it automatically to keep the escape valve just at the blowing point which is the exact reduced pressure. The controlling agent is the escape valve (*c*) with its well-known properties of accuracy and reliability, and this type of reducing valve has in consequence earned an exceptional reputation for the same qualities. A brass dome (*f*), open to the atmosphere, closes in the escape valve and protects it from injury, and may be under lock and key to prevent the valve being tampered with.





SHIP CANAL PROJECTS IN YORKSHIRE.—At the annual dinner of the Leeds Engineers' Association, Mr. B. Walker, the head of a large engineering firm in Leeds, took the opportunity of narrating what steps had been taken in improving the waterways between Leeds and the sea. He said the greatest attention had been given during the past year to the improvement of the River Ouse by the construction of training walls. These works, having been in progress about five years, had now reached an interesting stage. The diversion of the river to the east end of Goole Reach at the present moment makes the width of the river about 1,000 ft. The new channel will be 700 ft. in width. Out of a total of eight miles of river between Goole and the Humber, four miles have been dealt with. Where the improvements are completed, an increased depth of water of from 4 ft. to 5 ft. has been obtained. The walls are constructed of slag, brought by steam and discharged from hoppers of 500 tons, designed with water ballast to facilitate the discharge of the material under varying conditions. The walls are being constructed about 35 ft. wide at low water, the total height of the walls being about 50 ft., and when it is mentioned that it requires 12,000 to 13,000 tons of material to advance the walls 60 ft., the magnitude of the work may be realised. Progress has also been made in enlarging the waterway between Leeds and Goole, but some time must elapse before these works are completed. Already the improvements have resulted in a considerable advancement in the extent of the trade of Goole. There the shipment of coal has increased during the last three years from 66,200 tons to about 900,000 tons in 1890. He had a deep conviction that the future prosperity of Leeds could not be assured without some outlet on the seaboard. Leeds was the metropolis of the West Riding, and a ship canal would be an outlet to foreign parts of the greatest advantage to the other industrial centres of the West Riding. He said the Aire and Calder Navigation Co. were making extensions of their waterway, and had been engaged for five years in preparing for the admission of large ships to the port of Goole; and he had no doubt that when that was consummated Leeds steel would be sold as cheaply as was now the case with Middlesbrough steel. Also, should this project be accomplished, Leeds would get a ship canal for little cost, owing to the enterprise of the Aire and Calder Navigation Co. and to the local position of Leeds as to the sea. Then goods made in Yorkshire could for two months in the year be carried into Siberia, which was a vast fruitful plain ready to grow corn and to produce many things for the welfare of mankind.

THE "NEWARK."—The United States cruiser *Newark* has just made a builders' trial trip. The *Newark* is built of steel throughout, and she is 328 ft. long over all, and 310 ft. on load water line. Her beam is 49 ft., her depth 32 ft., and when in commission she will draw about 19 ft. Her motive power is two triple-expansion engines of 6000 horse-power, natural draught, but capable of working up to 8,500 horse-power under forced draught. The cylinders of each set of engines are 34 in., 48 in., and 76 in. in diameter, with a stroke of 40 in. Steam is furnished by four steel boilers, 13½ ft. in diameter by 19½ ft long, and made to sustain a pressure of 160 lb. per square inch. The grate surface is 540 ft. The coal supply is 400 tons, but the ship's bunkers have a capacity of 850 tons. In addition to the engines the *Newark* will be barque-rigged and have a sail area of 12,000 square ft. A protective deck of steel covers the engines, boilers, steering gear, and rudder head, and the engines and boilers are still further protected by a pit of coal. On her trial the *Newark* developed 9000 horse-power and a speed of 19¾ knots per hour.

THE estimates for the French Navy for the year 1891 amount to £8,750,708, of which about £2,000,000 is reserved for new vessels or alterations in existing vessels, and for their equipment.

LIST OF VESSELS LAUNCHED IN 1890.

* Compound. † Triple. ‡ High Pressure. ¦ Side Lever.
‖ Single. *a* Oscillating. *b* Quadruple.

ENGLISH.

By Strand Slipway Co., Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Amur	Steel	Steam	British	907	200
† Olus	"	"	"	911	200
† Balrar	"	"	Foreign	1,311	130

By Robt. Thompson & Sons, Southwick Yard, Sunderland.

† Relay	Steel	T.S.S.	British	1197·90	180
† Oria	"	Steam	"	2167·11	180
† Torquay	Iron	"	"	699·81	80
† Madrilens	Steel	"	"	3114·98	250
† Hiroshima-Maru	"	"	Foreign	3172·27	250
† Lincoln	"	"	British	115·93	40
† ——	"	"	"	909·0	90

By R. & J. Evans & Co., Brunswick Dock, Liverpool.

Atacama	Iron	Sail	B'tish	1,146	—

By J. Priestman & Co., Southwick, Sunderland.

† Siam	Steel	Steam	Foreign	1,576	150
† Gleneden	"	"	British	1,133	120
† Chamois	"	"	"	2,099	180
† Cecilia	"	"	"	1,169	120
† Ithamo	"	"	"	2,221	200
† Stalheim	"	"	Foreign	2,280	200

By Bartram, Haswell & Co., South Dock, Sunderland.

† Benedick	Steel	Steam	British	2,440	250
† Lyell	"	"	"	2,435	250
† Oberon	"	"	"	2,768	300
† Orient	"	"	Foreign	2,370	250

By William Pickersgill & Son, Southwick, Sunderland.

Nithsdale	Steel	Steam	British	1,897	160
Melbourne	"	"	"	3,819	270
Hanna Heye	Iron	Sail	Foreign	1,422	—
Drumalis	Steel	"	British	2,530	—
Andrada	"	"	"	2,555	—

By Wm. Doxford & Sons, Pallion, Sunderland.

† Mary Beyts	Steel	Steam	British	3764·25	450
† Sea King	"	"	"	3808·05	450
† Federal	"	"	"	2402·52	250
† Reaumur	"	"	Foreign	1539·50	160
† Valin	"	"	"	1548·72	160
† H. M. Pollock	"	"	British	2515·07	220
† Fazilka	"	"	"	4152·27	450
† Fultala	"	"	"	4155·95	450
† Hawkes Bay	"	"	"	4500·00	450

By Thos. & Wm. Smith, North Shields.

† E. S. Lancaster	Iron	Steam	British	543	70
† Balmore	Steel	"	"	1,272	110
† Sam Lancaster	Iron	"	"	541	70

By Osbourne, Graham & Co., Hylton, Sunderland.

† Tellus	Steel	Steam	Foreign	2,590	210
† Taff	"	"	British	871	90
† Ely	"	"	"	873	90
† Cape Breton	"	"	Foreign	1,764	160

By J. T. Eltringham & Co., Stone Quay, South Shields.

‖ Tyne Dock No. 5	Steel	Steam	British	105·86	50
† Eagle	"	"	Foreign	228·61	95
* Empress	Iron	"	British	103·98	40
* Crown Prince	"	"	"	109·56	40
* Westward Ho	"	"	"	110·63	40

By H. Fellows & Son, Yarmouth.

Britannic	Wood	S'lg. b'.e	B'tish	92	—

By J. L. Thompson & Sons, North Sands, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Caxo	Steel	Steam	British	2,061	180
† Pak-Ling	"	"	"	3,034	750
† Endeavour	"	"	"	2,795	230
† Queensland	"	"	"	3,892	350
† Forest Holme	"	"	"	2,407	250
† Lizzie	"	"	"	2,138	180
† Red Cross	"	"	"	2,877	230
† Fulwell	"	"	"	2,514	190
† Keemun	"	"	"	3,132	700
† Chelydra	"	"	"	2,720	230
† Cabo Silleiro	"	"	Foreign	1,060	85
† Cabo Prior	"	"	"	1,060	85
† Tyr	"	"	"	2,350	180

By Craig, Taylor & Co., Stockton-on-Tees.

† Shaftesbury	Iron	Steam	British	1,885	160
† Prudence	"	"	"	2,319	175
† Allegheny	"	"	"	2,913	250
† Hokkai Maru	"	"	Foreign	684	70
† Dunbeth	Steel	"	British	2,276	180
† Aquina	"	"	"	2,296	170
† Yung Ping	"	"	"	990	90
† Sophia Couppa	"	"	"	2,035	160

By Cook, Welton & Gemmell, South Bridge Road, Hull.

* Staghound	Iron	Steam	British	152	45
* Bloodhound	"	"	"	150	45
† Richard Simpson	"	"	"	185	60
* Otterhound	"	"	"	150	45
† Lycurgus	"	"	"	146	50
† Victoria	"	"	"	155	50
† Anglia	"	"	"	150	50
† Ceylon	"	"	"	169	50
† Mandalay	"	"	"	148	50
† Prince Consort	"	"	"	154	50
† Zenobia	"	"	"	145	45
† San Pedro	"	"	"	130	45
† Martaban	"	"	"	148	50
* Gibraltar	"	"	"	149	45
* Tasmania	"	"	"	149	45
† Egypt	"	"	"	145	45
* Sleuth-Hound	"	"	"	152	45

By Edward Finch & Co., Chepstow.

* Shamrock (tug)	Steel	Steam	British	85	50
* Fastnet "	Iron	"	"	70	40
* Salvor "	"	"	"	70	40
5 Barges	Steel	—	"	250	—
6 Barges	"	—	"	420	—
2 Barges	"	—	"	100	—
3 Barges	"	—	"	345	—

By W. H. Lean, Falmouth.

* Bertie	Iron	St'm	British	25	30

By Wm. White & Sons, West Cowes, Isle of Wight.

* Opal	Iron	Steam	Foreign	128	—
* Rambler	Wood	"	British	19	10
Ghost	"	Sail	"	25	—
* Insect	"	Steam	"	34	14
Dolphin	"	Sail	"	2¼	—
Pup	"	"	"	1	—

By W. H. Potter & Sons, Queen's Dock, Liverpool.

* Gorgon	Iron	Steam	British	986	85
Altair	"	Sail	Foreign	2,452	—
Dunfermline	Steel	"	British	2,903	—

By S. P. Austin & Son, West Dockyard, Sunderland.

† Austria	Steel	Steam	British	2,221	200
† Adriatico	"	"	Foreign	1,393	130
† Gladys	"	"	British	2,364	200

By J. G. Fay & Co., Limited, Southampton.

Averna	Composite	Sail	British	84·4	—
Castanet	"	"	"	37·14	—
* Humming Bird	"	Aux.	"	30·06	6

By T. TURNBULL & SONS, Whitby.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Fairmead	Steel&Iron	Steam	British	2,245	218
† Nethergate.. ..	,,	,,	,,	2,252	220
† Oswald	,,	,,	,,	1,835	170
† Vera	,,	,,	,,	2,350	218

By R. & H. GREEN, Blackwall.

Plover	Iron	Sail	British	150	—
Puffin	,,	,,	,,	150	—
Seamew	,,	,,	,,	150	—
Seagull	,,	,,	,,	150	—
Sealark	,,	,,	,,	150	—
Spoonbill	,,	,,	,,	150	—
Widgeon	,,	,,	,,	150	—
Wilduck	,,	,,	,,	150	—
Wimbrel	,,	,,	,,	150	—
Dunbird	,,	,,	,,	150	—
Petrel	,,	,,	,,	150	—
Curlew	,,	,,	,,	150	—
No. 62 Lightship..	Composite	,,	,,	200	—
,, 63 ,, ..	,,	,,	,,	200	—
a ,, 37 Bosphorus	Steel	Steam	Foreign	244	97
a ,, 38 ,, ..	,,	,,	,,	244	101
Dredger Barge ..	Iron	Sail	British	170	—
* Ellen	Iron& Steel	Steam	,,	50	40
† Asp, H.M.S. ..	Steel	,,	,,	180	50
Durham.. ..	,,	Sail	,,	120	—
York	,,	,,	,,	230	—

By SHORT BROS., Sunderland.

† Robert Eggleton ..	Steel	Steam	British	2,308	200
b Enchantress ..	,,	,,	,,	2,636	200
† George Allen ..	,,	,,	,,	2,310	200
† Aloedene	,,	,,	,,	2,412	200
† Imperial Prince ..	,,	,,	,,	2,526	200
b Highland Prince..	,,	,,	,,	2,510	200
† Joseph Davis ..	,,	,,	,,	2,282	200
b Beechdene ..	,,	,,	,,	2,508	200
† Chicago	,,	,,	,,	2,381	260
† T. G. Hutton ..	,,	,,	,,	700	90
† No. 202	,,	,,	,,	2,500	200

By ROPNER & SON (late M. Pearse & Co.), Stockton-on-Tees.

Avala	Steel	Steam	British	3,743	495
Newby	,,	,,	,,	2,168	200
Therese Heymann	,,	,,	,,	2,392	200
Inverness	,,	,,	,,	2,251	160
Pakeha	,,	,,	,,	2,331	500
Danby	,,	,,	,,	2,259	200
Tynehead	,,	,,	,,	2,258	200
Feronia	,,	,,	,,	2,966	220
Hesper	,,	,,	,,	2,720	190
Uplands	,,	,,	,,	2,274	180
Llanthony Abbey..	,,	,,	,,	2,420	200
Calcutta City ..	,,	,,	,,	2,880	200

By RICHARDSON, DUCK & Co., South Stockton Iron Shipyard, Stockton-on-Tees.

Eugenie	Iron	Steam	British	1,791	190
Castlefield.. ..	,,	,,	,,	2,255	170
Montebello ..	Steel	,,	,,	1,736	230
Girdleness ..	,,	,,	,,	1,851	160
Darlington ..	,,	,,	,,	2,523	200
Etona	,,	,,	,,	2,512	300
Congo	,,	,,	,,	2,905	200
Prins William I...	,,	,,	Foreign	1,676	250
Orfordness ..	,,	,,	British	1,933	160
Vala	,,	,,	,,	2,530	260
No. 378	,,	,,	,,	3,000	200
3 Thames Barges..	Iron	,,	,,	150	—

By WILLIAMSON & SON, Workington.

Stanley Force ..	Steel	Steam	British	372	60
Eusemere	,,	Sail	,,	2,512	—

By NEWALL & Co., St. Philip's Iron Works, Bristol.

Novorossisk ..	Steel	Steam	Foreign	.50	40

By EDWARDS' SHIPBUILDING Co., LTD., Howdon-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G T. Regis.	H.P. N.
† Kilmore	Steel	Steam	British	2,250	190
† Naparima	,,	,,	,,	1,700	160
† Pallas	,,	,,	Foreign	1,150	100
† Hollinside.. ..	,,	,,	British	1,150	130
† Markomannia ..	,,	,,	Foreign	3,500	350
† ——	,,	,,	British	700	80

By MILFORD HAVEN SHIPBUILDING Co., Milford Haven.

† Dieppois	Steel	Steam	Foreign	1,282	150
† Cookham	,,	,,	British	1,594	180
* Birda	Steel & Ir'n	,,	,,	132	50
Speke	Steel	Sail	,,	2,860	—

By A. W. ROBERTSON & Co., Lea Shipbuilding Yard, Canning Town.

30	Steel	Sail	Foreign	400	—
31	,,	,,	,,	400	—
Wolf	,,	,,	British	160	—
Longships.. ..	,,	,,	,,	160	—
* Adder	,,	Steam	,,	9	10
* Euthamia.. ..	Iron	Trawl	,,	141·8	45
Bahamas	Steel	Sail	,,	160	—
Dondrahead ..	,,	,,	,,	160	—
Welmaduwa ..	,,	,,	,,	160	—
Sombrero	,,	,,	,,	160	—

By R. CRAGGS & SONS, Middlesbro' and Stockton-on-Tees.

† Ingleby	Steel	Steam	British	1,786	175
† George Coutzis ..	,,	,,	Foreign	885	99
† Helgoland	,,	,,	,,	525	70
† Sam Handford ..	,,	,,	British	1,832	150
† ——	,,	,,	—	526	70

By JOHN BLUMER & Co., North Dock, Sunderland.

Centurion	Steel	Steam	British	1,942	180
Trinidad	,,	,,	,,	1,280	120
Clara	,,	,,	,,	1,854	170
Brenttor	,,	,,	,,	1,951	170
Lynton	,,	,,	,,	1,668	150
Tigris	,,	,,	,,	2,412	220
Amara	,,	,,	,,	2,443	220
Surrey	,,	,,	,,	720	90

By COTTINGHAM BROS., Goole.

Spartan	Wood	Sail	British	77·$\frac{38}{100}$	—

By BUTE SHIPBUILDING & ENGINEERING DRY DOCK Co., Limited, Cardiff.

† Mayfield	Steel	Steam	British	2,500	240

By HARVEY & Co., LTD., Hayle.

† Tongshaw ..	Steel	Steam	British	1,750	156
† Penwith	,,	,,	,,	1,977	156
† Penpol	,,	,,	,,	2,106	156

By R. WATKINS & Co., Blackwall.

‡ Humber No. 2 ..	Wood	Steam	British	15	10
* Mersey	,,	—	,,	35	28
* Antigua	,,	—	,,	42	30

By R. IRVINE & Co., West Hartlepool.

† Gladesby	Steel	Steam	British	2,360	170
† Lizzie Cory ..	,,	,,	,,	1,214	100
† Sunshine	,,	,,	,,	1,588	120
† Rubio	,,	,,	,,	1,518	125
† Chatfield	,,	,,	,,	2,890	230

By PENARTH SHIPBUILDING Co., Penarth.

* Wave	Steel	Steam	British	48	12
* Solway Prince ..	Iron	,,	,,	349	55
* Aira Vorce ..	,,	,,	,,	350	55

By RITSON & Co., Maryport.

Peter Wedale ..	Steel	Sail	British	2,000	—
Criffel	,,	,,	,,	1,200	—

By Edward Withy & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Blenheim	Steel	Steam	British	2,248	200
† Amie	Iron	,,	,,	1,803	190
† Zampa	Steel	,,	,,	2,364	200
† Norna	,,	,,	,,	2,242	200
† Ashlands	,,	,,	,,	2,303	200
† Bushmills	,,	,,	,,	2,466	250
† Capenor	,,	,,	,,	2,536	210
† Alacrity	,,	,,	,,	2,190	180
† Glenisle	,,	,,	,,	1,944	180
† Zanzibar	,,	,,	,,	2,964	300
† Wildcroft	,,	,,	,,	2,964	300

By Schlesinger, Davis & Co., Wallsend-on-Tyne.

† Bendi	Steel	Steam	British	3,518	300
† Bendo	,,	,,	,,	3,489½	300
† Progress	,,	,,	Foreign	859½	90

By James Laing, Deptford Yard Sunderland.

Perou	Steel	Steam		3,164	250
Umkuzi	,,	,,	—	2,049	250
Aros	,,	,,	—	1,806	150
Baria	,,	,,	—	3,069	325
Patapsco	,,	,,	—	2,933	300
Ville de Paris ..	,,	,,	—	3,534	360
Saint Hubert ..	,,	,,	—	3,046	325
Umona	,,	,,	—	2,050	250
Barrowdale ..	,,	,,	—	1,050	110

By Day, Summers & Co., Southampton.

† Tyrian	Steel	Steam	British	1,455	220
† Norseman	,,	,,	,,	940	130

By Camper & Nicholson, Gosport.

Blue Rock..	Wood	Sail	B'tish	70	—

By Edwin Clark & Co., Brimscombe, near Stroud.

‡ Pioneer	Steel	Steam	Foreign	3	3
‡ Chopinette ..	,,	,,	British	—	3
† Kingston	,,	,,	,,	18	13
‡ Ada	,,	,,	Foreign	—	4
‡ Armorel	,,	,,	British	5	6

By Royden & Sons, Queen's Dock, Liverpool.

† Indrapura	Steel	Steam	British	3,859	—
† Saladin	Iron	,,	,,	1,998	—
† Obidense	Steel	,,	,,	2,379	—
Crompton	,,	Sail	,,	2,809	—

By Blyth Shipbuilding Co., Limited.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P I.
† Prodano	Steel	Steam	British	2,476	1,200
† Matteo Premuda ..	,,	,,	Foreign	1,087	606
† Corea	,,	,,	British	1,769	960
† Ching Ping ..	,,	,,	,,	856	500
† Fuping	,,	,,	,,	856	500
† Cairnie	Iron	,,	,,	215	220

By Cochrane, Cooper & Schofield, Grove Hill, Beverley.

† Una	Iron	Steam	British	154	320
* Helen McGregor ..	,,	,,	,,	155	270
* Angus	,,	,,	,,	140	210
† India	,,	,,	,,	169	320
† Malta	,,	,,	,,	169	320
† Fly	,,	,,	,,	158	270
† Stanley	,,	,,	,,	159	270
† Volta	,,	,,	,,	157	270
† Nyanza	,,	,,	,,	152	320
† Teutonic	,,	,,	,,	151	320
† Majestic	,,	,,	,,	151	320
† Natal	,,	,,	,,	169	320
† Ant	,,	,,	,,	158	270
† Bombay	,,	,,	,,	169	320

By Laird Brothers, Birkenhead.

Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	H.P. I.
† Norseman	Steel	Steam	British	231	350
† Almirante Lynch	,,	,,	Foreign	613	4,500
† Almirante Condell	,,	,,	,,	613	4,500
† Espora	,,	,,	,,	433	3,250
† Rosales	,,	,,	,,	433	3,250
† Ottoman	,,	,,	British	4,843	3,000
† 9 de Julio	,,	,,	Foreign	2,000	3,000

By Sunderland Shipbuilding Co., Sunderland.

† Denia	Steel	Steam	Foreign	1668·47	900
† Calabro	,,	,,	British	2066·76	1,500
† Asloun	,,	,,	,,	2828·36	1,500
† Scharlachberger ..	,,	,,	Foreign	2902·33	1,500
† Aquitaine ..	,,	,,	,,	3,200	2,500
† Braunfels ..	,,	,,	,,	3,050	1,500

By Tyne Iron & Shipbuilding Co., Ltd., Willington Quay-on-Tyne.

† Strathdon	Steel	Steam	British	2,643	1,500
† Time	,,	,,	Foreign	2,575	1,500
† Narruka	,,	,,	British	1,814	1,000
† Mendelssohn ..	,,	,,	,,	2,654	1,600
† Tripoli	,,	,,	,,	2,627	1,500
† Monmouth ..	,,	,,	,,	2,506	1,400
† Bawtry	,,	,,	,,	2,407	1,350
† Renwick	,,	,,	,,	790	400

By Earles Shipbuilding & Engineering Co., Ltd., Hull.

† Tasso	Steel	Steam	British	1,328	1,500
† Urania	Iron	,,	,,	183	400
† Volo	Steel	,,	,,	1,289	1,500
† Gaelic	Iron	,,	,,	159	400
† Hellenic	,,	,,	,,	159	400
† Ionic	,,	,,	,,	159	400
† Jurassic	,,	,,	,,	159	400
† Achilles	,,	,,	,,	148	370
† Avalon	,,	,,	,,	845	710
† Endymion, H.M.S.*	Steel	,,	,,	7,350	12,000
† St. George ,, *	,,	,,	,,	7,700	12,000
† Pearl ,,	—	—	,,	—	7,500
† Philomel ,,	—	—	,,	—	7,500
† Andromache ,,	—	—	,,	—	9,000
† Apollo ,,	—	—	,,	—	9,000

* Building

By Wm. Harkess & Son, East Slipway, Middlesbro'-on-Tees.

Poherua	Steel	Steam	British	1,800	750
Elisa Cerana ..	,,	T. S.	,,	460	900
Dartmouth ..	Iron	Steam	,,	140	300
Avonmouth ..	,,	,,	,,	140	300
No. 125	Steel	,,	,,	2,000	750
Haugesund ..	,,	,,	Foreign	1,000	550
3 Barges	,,	Sail	,,	60	—

By John Readhead & Co., West Docks, South Shields.

† Trevalgan	Steel	Steam	British	2420·46	1,360
† Trevillian	,,	,,	,,	2428·59	1,365
† K. Stathatos ..	,,	,,	Foreign	2340·21	1,368
† Trevaylor	,,	,,	British	2426·00	1,363
† Charles T. Jones ..	,,	,,	,,	2422·19	1,364
† Sarah Jolliffe ..	Iron	,,	,,	299·19	592
† Ethelwalda ..	Steel	,,	,,	2431·36	1,366
† Marston Moor ..	,,	,,	,,	2430·29	1,365
† N. Verberckmoes ..	,,	,,	Foreign	1440·48	806
† Whitefield	,,	,,	British	2450·00	1,368
† Cereda	,,	,,	,,	2511·00	1,366

By John Jones & Sons, Brunswick Dock, Liverpool.

† Ville de St. Briene .	Steel	Steam	Foreign	216·49	300
† Minho	,,	,,	British	834·89	503
† Calmore	,,	,,	,,	650·14	700
† Mersey	,,	T. S.	,,	391·1	950
† Wirral	,,	,,	,,	391·1	950

By Southampton Naval Works, Southampton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Katy	Steel	Sail	Foreign	2,250	—
† Memphis	,,	Pad'le	,,		300
* Theresopolis	,,	Screw	,,		64

By Wood, Skinner & Co., Bill Quay, Newcastle-on-Tyne.

† Walker	Steel	Steam	British	606	520
† Cossack	,,	,,	Foreign	786	480
† Kong Inge	,,	,,	,,	690	550
† Kong Trygve	,,	,,	,,	690	550
† Tamarind	,,	,,	,,	1,245	680
† Oscarshal	,,	,,	,,	1,245	620
† Cfyda	,,	,,	,,	1,245	620
† Frogner	,,	,,	,,	1,245	620
† Skuld	,,	,,	,,	1,245	620
† Kitty	,,	,,	,,	1,068	780

By Robert Stephenson & Co., Hebburn-on-Tyne.

† Arroyo	Steel	Steam	Foreign	3,563	1,800
† Cheruskia	,,	,,	,,	3,372	1,800
† Francisco	,,	,,	British	4,559	3,000
† Cornhill	,,	,,	,,	901	700
† Sybille, H.M.S.	,,	,,	,,	3,400	9,000

By Cochran & Co., Birkenhead.

* Mallard	Steel	Steam	British	16	35
* Colonel	Wood	,,	Foreign	5	16
* Admiral	,,	,,	,,	5	16
* Lady Gormanston	Teak	,,	,,	10	16
Demon	Wood	Cutter	British	2	—
‡ ——	,,	Steam	—	5	10
Barge	Steel	—	Foreign	7	—
Constancia	,,	—	,,	20	—
* Soengen Rawa	,,	Steam	,,	210	80
* Saxon (converted)	Wood	,,	British	66	80

By R. & W. Hawthorn, Leslie & Co., Limited, Hebburn on-Tyne.

Chantrey	Steel	Steam	British	2,823	1,600
Phidias	,,	,,	,,	2,823	1,600
Gulf of Ancus	,,	,,	,,	2,717	1,800
Grand Duke Alexis	,,	,,	Foreign	1,874	3,600
Largo Bay	,,	,,	British	2,027	1,100
Grd. Dk. Constantine	,,	,,	Foreign	1,874	3,600
H.M.S. Bellona	,,	T. S.	British	1,850	6,000
Gulf of Florida	,,	Steam	,,	2,850	1,600
Mossoro	,,	,,	Foreign	850	500

By Wm. Gray & Co., Limited, West Hartlepool.

† Umbilo	Steel	Steam	British	1,923	1,050
† Armenia	,,	,,	,,	2,330	1,000
† Bussorah	,,	,,	,,	2,358	950
† Pocklington	,,	,,	,,	1,390	650
† Windsor	,,	,,	,,	2,793	1,250
† Hounslow	,,	,,	,,	2,797	1,250
† Fulham	,,	,,	,,	2,024	1,000
† Kingsland	,,	,,	,,	2,016	1,000
† Manchester	,,	,,	,,	2,072	900
† Langoe	,,	,,	,,	2,306	950
† Halifax City	,,	,,	,,	2,289	950
† Rangatira	,,	,,	,,	4,045	2,000
† Malvern	,,	,,	,,	2,493	1,250
† Tekoa	,,	,,	,,	4,050	2,000
† Sestas	,,	,,	Foreign	1,447	750
† Elloe	,,	,,	British	1,744	700
† Ipsden	,,	,,	,,	1,748	700
† Coatham	,,	,,	,,	1,771	700
† Umhloti	,,	,,	,,	2,173	1,250
† Herman Wedel Jarlsberg	,,	,,	Foreign	3,023	1,250
† Frieda	,,	,,	British	2,072	900
† Oaklands	,,	,,	,,	1,948	750
† Macduff	,,	,,	,,	2,905	1,300
† Guernsey	,,	,,	,,	2,797	1,100
† Heighington	,,	,,	,,	2,795	1,100
† Taurus	,,	,,	Foreign	2,150	700
† Clyde	,,	,,	British	2,794	1,000

By Sir W. G. Armstrong, Mitchell & Co., Low Walker

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P I.
25th de Mayo	Steel	Steam	Foreign	2,180	13,500
Wallaroo	,,	,,	British	1,493	7,500
Plassy	,,	,,	,,	564	4,500
Standard	,,	,,	Foreign	2,765	1,500
Bear Creek	,,	,,	British	2,411	1,200
Beacon Light	,,	,,	,,	2,763	1,500
Geestemünde	,,	,,	Foreign	2,750	1,500
Ewo	,,	,,	British	423	400
Helgoland	,,	,,	Foreign	2,397	1,200
Sirius	,,	,,	British	1,840	9,000
Salatiga	,,	,,	Foreign	2,454	2,000
Brilliant	,,	,,	,,	3,162	1,550
Cargo Steamer	,,	,,	—	2,908	1,350

By Sir Raylton Dixon & Co., Cleveland Dockyards, Middlesbrough.

Storm King	Steel	Steam	British	3,370	2,500
Monrovia	,,	,,	,,	2,402	1,000
Ruskin	,,	,,	,,	2,392	1,000
Yumuri	,,	,,	Foreign	844	870
Rockabill	,,	,,	British	2,485	1,000
Dolores	,,	,,	,,	2,189	900
Lomas	,,	,,	,,	2,204	900
Tandil	,,	,,	,,	2,181	900
Alfalfa	,,	,,	,,	2,184	900
Salado	,,	,,	,,	2,188	900
Sold	,,	,,	,,	2,189	900
Weybridge	,,	,,	,,	2,484	1,000
Maniv	,,	,,	,,	2,160	900
Franklin	,,	,,	,,	2,174	900
Hero	,,	,,	,,	797	400
Seal	Iron	,,	,,	136	320
Mayumba	Steel	,,	,,	2,516	1,100
Oil Rivers	,,	,,	,,	2,850	1,200
Justin	,,	,,	,,	2,220	900
Kintuck	,,	,,	,,	3,700	3,000

By The Naval Construction & Armaments Co., Limited, Barrow-in-Furness.

Coomassie	Steel	Steam	—	2,625	1,600
Empress of India	,,	T. S.	British	5,920	10,000
Empress of Japan	,,	,,	,,	5,920	10,000
H.M.S. Latona	,,	,,	,,	3,400	9,000
,, Melampus	,,	,,	,,	3,400	9,000
,, Naiad	,,	,,	,,	3,400	9,000
Araucania	—	Steam	—	—	2,000
Patagonia	—	,,	—	—	2,000

By C. S. Swan & Hunter, Wallsend-on-Tyne.

† Abbeymoor	Steel	Steam	British	2,405	1,200
† Arundo	,,	,,	Foreign	1,834	1,000
† Madagascar	,,	,,	,,	2,909	1,700
† Julia	,,	,,	,,	1,240	700
† Radnorshire	,,	,,	British	2,898	1,600
† Citta di Venezia	,,	,,	Foreign	3,551	3,350
† Adriana	,,	,,	,,	3,114	1,700
† Tosari	,,	,,	,,	2,481	2,000
† Lawang	,,	,,	,,	2,481	2,000
† Priok	,,	,,	,,	2,481	2,000
† ——	,,	,,	British	1,060	1,700

By Wigham Richardson & Co., Neptune Works, Newcastle-on-Tyne.

Chios	Steel	Steam	—	1,710	1,000
Ragnvald Jarl	,,	,,	—	1,106	1,300
Kabyle	,,	,,	—	1,368	1,750
Tafna	,,	,,	—	1,369	1,750
No. 271	,,	,,	—	55	—
Enskar	,,	,,	—	3,093	1,650
Holkar	,,	,,	—	3,300	1,800
Hedwig Woormann	,,	,,	—	1,276	700
Gretchen Bohlen	,,	,,	—	1,281	700
Strathdon	—	,,	—	—	1,300
Time	—	,,	—	—	1,300
Monmouth	—	,,	—	—	1,200
Donau	—	,,	—	—	1,300

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
By Yarrow & Co., Poplar, London, E.					
Two boats ..	—	Steam	Foreign	—	—
Two steamers ..	—	Screw	,,	—	—
Two side-wheel ..	—	Steam	,,	—	—
† Five torpedo-boats	—	,,	,,	—	1,120
b One ,, ..	—	,,	,,	—	1,240
† Eight ,, 2nd class	—	,,	,,	—	235
Two gunboats ..	—	,,	,,	—	100
Two stern-wheel ..	—	,,	,,	—	—
One launch ..	—	,,	,,	—	—
One stern-wheel ..	—	,,	,,	—	—
Two launches ..	Steel	—	—	—	—
By Wm. Dobson & Co., Low Walker, Newcastle-on-Tyne.					
† Lansdowne Tower	Steel	Steam	British	3,191	1,400
† Hereford	,,	,,	,,	2,647	1,350
Tynemouth Castle	,,	Sail	,,	173	1,350
† Wharfe	,,	Steam	,,	914	1,650
† Hoseinee	,,	,,	Foreign	1,601	800
† Astrologer.. ..	,,	,,	British	912	600
† Lomonosoff ..	,,	,,	Foreign	1.000	600
By Thames Iron & Shipbuilding Co., Limited, Blackwall.					
a D. Amelia	Iron	Steam	Foreign	$252\frac{59}{64}$	250
† Blenheim	Steel	,,	British	9,000	20,000
* Sarmiento ..	,,	,,	Foreign	$223\frac{43}{64}$	250
* No. 39	,,	,,	,,	$369\frac{39}{64}$	540
* ,, 40	,,	,,	,,	$369\frac{39}{64}$	540
† Limpopo	Iron	,,	,,	$261\frac{31}{64}$	350
a Woolwich	Steel	,,	British	$196\frac{3}{64}$	200
By Forrestt & Son, Wyvenhoe, Essex.					
Barge	Iron	—	Foreign	116	—
Creole	Composite	Sail	British	54	—
2 Barges	Galv. Steel	—	Foreign	13	—
Whale-boat ..	,,	Sail	,,	4	—
Archee	Wood	,,	British	6	—
3 Whale-boats ..	Galv. Steel	,,	Foreign	6	—
* Wyvern	Composite	Steam	British	25	75
Launch	Steel	,,	,,	8	—
* Creole	Wood	,,	,,	6½	40
4 Lighters.. ..	Galv. Steel	Sail	Foreign	16	—
* 2 Twin-screws ..	,,	Steam	,,	20	80
5 Whale-boats ..	,,	Sail	,,	15	—
Cutter	,,	,,	British	1½	—
2 Whale-boats ..	,,	,,	,,	2	—
By Palmer's Shipbuilding & Iron Co., Limited, Jarrow-on-Tyne.					
Jane Radcliffe ..	Steel	Steam	British	1,839	1,000
Irene	,,	,,	,,	542	3,000
Arab	,,	,,	,,	4,247	2,200
Douglas Hill ..	,,	,,	,,	2,171	1,150
British Queen ..	,,	,,	,,	4 387	2,600
Knight Commander	,,	,,	,,	4,305	2,600
Pique..	,,	,,	,,	1,800	9,000
Loch Muree.. ..	,,	,,	,,	2,697	1,300
Knight of St. George	,,	,,	,,	4,709	2,600
Eustathion Vlassopuls	,,	,,	Foreign	2,591	1,200
Saint Enoch.. ..	,,	,,	British	4,315	2,200
Europe	,,	,,	,,	5,300	3,300
Bumboro	,,	,,	,,	2,016	1,200
British King ..	,,	,,	,,	4.387	2,600

SCOTCH.

By A. & J. Inglis, Pointhouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners,	G.T. Regis.	H.P. N.
† Palamcotta ..	Steel	Steam	British	3,413	400
† Pentakota.. ..	,,	,,	,,	3,418	400
† Kola	,,	,,	,,	1,192	300
† Rasmara	,,	,,	,,	892	300
† Wodonga	,,	,,	,,	2,341	400
* Gertrude	,,	,,	,,	188	50
† No. 216	,,	,,	,,	110	50

By W. B. Thomson & Co., Limited, Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	H.P. N.
† Ptarmigan ..	Steel	Steam	British	1,240	200
† Flying Eagle ..	,,	,,	,,	337	100
† Perth	,,	,,	,,	1,729	450
† Aranmore.. ..	Iron	,,	,,	1,169	260
† Garnet	Steel	,,	,,	1,608	230
† Tuskar	Iron	,,	,,	1,206	260
† Valentia	Steel	,,	,,	417	80
† Princess Irene ..	,,	,,	,,	757	100
By Caird & Co., Greenock.					
† Wistow Hall ..	Steel	Screw	British	3,314	450
† Netherby Hall ..	,,	,,	,,	3,316	450
† Gulf of Lions ..	,,	,,	,,	2,680	450
† Prinses Sophie ..	,,	,,	Foreign	3,504	550
† Prins Hendrik ..	,,	,,	,,	3,504	550
By Wm. Hamilton & Co., Port-Glasgow.					
* Vauban	Steel	Steam	Foreign	1,553	150
Barcraig	,,	Sail	British	2,149	—
Astrée	,,	,,	,,	2,149	—
By James & George Thomson, Limited, Clydebank Shipbuilding Yard, Glasgow.					
† Brazil	Steel	Steam	Foreign	2,000	2,300
† Chiyoda	,,	,,	,,	2,500	6,000
† Frederica	,,	,,	British	1,100	6,000
† Lydia	,,	,,	,,	1,100	6,000
† Stella	,,	,,	,,	1,100	6,000
† Terpsichore ..	,,	,,	,,	3,500	9,000
† Thetis	,,	,,	,,	3,500	9,000
By Campbeltown Shipbuilding Co., Campbeltown.					
† Dieppois	Steel	Steam	Foreign	1,728	140
† Despina	,,	,,	British	1,223	98
By John Scott & Co., Kinghorn, Fifeshire.					
† Buccaneer ..	Steel	Stean	British	939	185
† Dundee	,,	,,	,,	839	195
† Scottish Belle ..	,,	,,	,,	14[illegible]	50
† Balmoral Castle ..	,,	,,	,,	146	50
† Strathdee ..	,,	,,	,,	132	50
By Napier Shanks & Bell, Yoker, Glasgow.					
Hygeia	Steel	Steam	British	987	480
† Claudine	,,	,,	Foreign	785	115
† Innamincka ..	,,	,,	British	2,501	460
† Irene	,,	,,	,,	1,343	[illegible]41
By D. M. Cumming, Blackhill Dock, Glasgow.					
‡ ——	Steel	S. P.	Foreign	85	50
* Albarden	Iron & steel	Steam	,,	60	26
By Hall, Russel & Co., Aberdeen.					
† Illovo	Steel	Steam	British	1.930	250
* Duchess of Fife ..	,,	,,	,,	672	100
† Garthdee	,,	,,	,,	681	100
* North East ..	,,	,,	,,	114	50
* North West ..	,,	,,	,,	114	50
† Inyoni	,,	,,	,	1,945	250
* North Wind ..	,,	,,	,,	114	50
* North Coast ..	,,	,,	,,	114	50
By A. Hall & Co., Footdee, Aberdeen.					
† Iaboatao	Stee	Steam	Foreign	653	120
† Coimbra	,,	,,	,,	699	85
* Hopper Dredger ..	,,	,,	British	120	20
* Annie Walker ..	Iron	,,	,,	123	50
By Murray Bros., Dennystown, Dumbarton.					
† Number Twelve ..	Steel	Steam	British	463	—
† Oakland	,,	,,	,,	398	—
* Cambria	Iron	,,	,,	43	—
‡ Steam Launch ..	Steel	,,	Foreign	15	—
‡ ,, ...	,,	,,	,,	35	—
* Clutha, No. 7 ..	Stee	,,	British	75	—
* ,, No. 8 ..	,,	,,	,,	75	—

By Ramage & Ferguson, Leith.

Name of Vessel.	Built of	Class.	Owner.	G.T. Regis.	H.P. N.
† Henng Shan	Steel	T. S.	British	1,998	344
† Talune	,,	Steam	,,	1,991	234
Orion	,,	Sail	,,	2,081	—
† St. George	Composite	Steam	,,	629	150
† Nevada	Steel	,,	,,	1,285	99
† Tyne	,,	,,	,,	600	120

By Russell & Co., Port-Glasgow and Greenock.

Bremerhaven	—	Steam	Foreign	3,392	—
Lanark	—	,,	British	3,109	—
Lord Bangor	—	,,	,,	2,990	—
Ouraka	—	,,	Foreign	2,637	—
Strathaven	—	,,	British	2,671	—
Strathallan	—	,,	,,	2,336	—
Strathesk	—	,,	,,	2,270	—
Teixeirinha	—	,,	,,	331	—
Glencona	—	Sail	,,	2,631	—
Holt Hill	—	,,	,,	2,398	—
Breidablik	—	,,	Foreign	2,416	—
Snaigow	—	,,	British	2,384	—
Thistlebank	—	,,	,,	2,390	—
Comliebank	—	,,	,,	2,283	—
Elmbank	—	,,	,,	2,287	—
Strathgryfe	—	,,	,,	2,275	—
Simla	—	,,	,,	2,213	—
Garnet Hill	—	,,	,,	2,274	—
Hinemoa	—	,,	,,	2,283	—
Port Stanley	—	,,	,,	2,276	—
Edenballymore	—	,,	,,	1,726	—
Templemore	—	,,	,,	1,716	—
Culmore	—	,,	,,	1,720	—
Socotra	—	,,	,,	1,718	—
Cambrian King	—	,,	,,	1,717	—
Burmah	—	,,	,,	1,734	—
Ordnamurchan	—	,,	,,	1,717	—
Dumbarton Rock	—	,,	,,	1,716	—
Skjold	—	,,	Foreign	1,560	—
Nordlyset	—	,,	,,	1,565	—
Invermark	—	,,	British	1,435	—
Birtha	—	,,	Foreign	1,430	—
Quilpné	—	,,	British	1,386	—
Miefield	—	,,	,,	1,368	—

By J. McArthur & Co., Abbotswich, Paisley.

* Nautilus	Steel	Steam	British	360	350
Watasoo	—	,,	,,	210	360
——	—	,,	Foreign	109	90
——	—	—	,,	95	—
* Meno	—	Steam	British	132	130

By S. M'Knight & Co., Ayr, N.B.

† Ethelred	Steel	Steam	British	894	130
* Hornby	Iron	,,	,,	197	80
† Talbot	Steel	,,	,,	547	90
† Garnock	,,	,,	,,	436	75
† Burnock	,,	,,	,,	436	75

By Robert Duncan & Co., Limited, Port Glasgow.

† Brand	Steel	Steam	Foreign	1,980	170
† Apa	,,	,,	British	432	60
† Andromeda	,,	Ship	Foreign	1,928	—
† Kelton	,,		British	1,924	—
† Glenbreck	,,		,,	1,899	—
† Pass of Brander	,,	,,	,,	2,127	—

By John Reid & Co., Port Glasgow.

White Heather	Steel	Yacht	British	636	500
Marchioness of Breadalbane	,,	P. S.	,,	246	140
Marchioness of Bute	,,		,,	246	140

By Alexr. Stephen & Sons, Linthouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Fascadall	Steel	Sail	British	2,083	—
† Highland Chief	,,	Steam	,,	2,780	240
† Asphodel	,,	,,	,,	2,808	240
† Queen Margaret	,,	,,	,,	2,812	300
† Ben Lomond	,,	,,	,,	2,803	350
† Boston	,,	,,	,,	1,695	550
† Ottawa	,,	,,	,,	1,860	225

By Lobnitz & Co., Slip Dock, Renfrew, N.B.

† Compania de Filipinas	Steel	Steam	Foreign	700	100
8 Lighters	Iron	—	,,	800	—
* The Couloir Drdgrs	,,	Steam	,,	500	300
* Dredger	Steel	,,	,,	400	200
Waterboat	Composite	—	,,	15	—
* Launch	Steel	Steam	,,	38	20
One Rock-cutter	—	—	,,	100	—

By William Denny & Bros, Leven Shipyard, Dumbarton.

Princess Victoria	Steel	P. S.	British	1,096	—
Clacton Belle	,,	,,	,,	458	—
Rotokino	,,	Steam	Foreign	2,004	—
Tavinni	,,	,,	,,	1,465	—
Duchess of Hamilton	,,	P. S.	British	553	—
Valada	,,	Steam	Foreign	3,334	—
Virawa	,,	,,	,,	3,333	—
Telunga	,,	,,	,,	5,186	—
Scot	,,	T.S.S.	British	7,000	—
Two Paddle Steamers and Four Cargo Flats, shipped to India				4,080	—

By Gourlay Bros. & Co., Dundee.

Circassie	Steel	Steam	Foreign	2,241	300
Hirondelle	,,	,,	British	1,610	380
Bullarra	,,	,,	Foreign	1,725	250
America	,,	,,	British	5,020	560
Ptarmigan	,,	,,	,,	1,020	—

By David McGill & Co., Irvine, N.B.

* Gannet	Iron	Steam	British	228	60
* Merlin	,,	,,	,,	151	35
* Yacht Arab	Steel	,,	,,	18	7

By Scott & Co., Bowling, Glasgow.

† Cornelian	Iron& steel	Steam	British	369	60
* Bute No. 2	Iron	,,	,,	170	50
† Olivine	Iron& steel	,,	,,	477	60
† Pebble	,,	,,	,,	477	60
† Pyrope	,,	,,	,,	477	60

By Alexr. Stephen & Sons, Dundee.

Mayhill	Steel& iron	Sail	British	2,121	—
Galena	,,	,,	,,	2,294	—

By Fleming & Ferguson, Paisley.

b Duckenfielde	Steel	Steam	British	1,200	400
b Dredger	,,	,,	Foreign	500	150
* Muna	,,	,,	,,	240	200
b Imogen	,,	,,	,,	410	300
* Mersey	,,	,,	British	400	120
* David Davies	,,	,,	,,	1,000	300
* Frias	,,	,,	,,	600	200
* Salford	,,	,,	,,	400	120
b Two Barges	,,	,,	Foreign	400	150

By John Fullerton & Co., Paisley,

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
• Rostrevor	Iron	Steam	British	191·76	250
† The Prince	,,	,,	,,	389·71	480
† The Duke	,,	,,	,,	387·51	480
† The Marquis	,,	,,	,,	389·71	480
• Mechelin	,,	,,	Foreign	333·93	290
• ——	Steel	,,	—	81·37	200

By Barclay, Curle & Co., Limited, Whiteinch, Glasgow.

† Benares	Steel	Steam	Foreign	2,964	2,000
† Puig Suey	,,	,,	British	3,079	3,000
† Doune Castle	,,	,,	,,	4,046	3,100
† Lismore Castle	,,	,,	,,	4,046	3,100
Cape York	,,	Sail	,,	2,127	—
† Pickhuben	,,	Steam	Foreign	3,000	1,600
† Hercules	,,	S. T.	British	234	1,000

By Ailsa Shipbuilding Co., Troon.

† Kasara	Steel	Steam	British	1,195	1,800
† Vasna	,,	,,	,,	905	900
† Vita	,,	,,	,,	905	900
† Amra	,,	,,	,,	518	980
† Lavinia	,,	,,	,,	419	520
† Iron King	,,	,,	,,	452	520
† Lord Ailsa	,,	,,	,,	1,650	950

By Alley & MacLellan, Polmadie, Glasgow.

Twin-screwSteamer	—	Steam	Foreign	850	400
3 Stern Wheel	—	,,	,,	210	450
1 ,, ,,	—	,,	,,	60	150
3 Barges	Steel	—	,,	225	—
1 Screw Tug	—	,,	,,	15	60
3 Dahabeahs	—	,,	,,	450	—
6 Barges	—	—	,,	240	—
4 ,,	—	—	,,	340	—
1 Paddle	—	Steam	,,	35	—
3 Barges	—	—	,,	960	—

By Archd. McMillan & Son, Limited, Dumbarton.

Planeta	Steel	Steam	British	1,400	1,300
Swanhilda	,,	Sail	,,	2,150	—
Petropolis	,,	Steam	Foreign	290	1,300
Invergarry	,,	Sail	British	1,440	—

By Wm. Simons & Co., Renfrew.

† Finnieston	Steel	Steam	British	300	500
† Ayame	Iron	,,	Foreign	401	320
† Manchester	Steel	,,	British	900	1,300
† Mermaid	Iron	,,	,,	1,050	1,300
† John Milne	Steel	,,	,,	350	500
† Wm. Bell	,,	,,	,,	350	500
Hopper Barge	Iron	,,	Foreign	80	—
,, ,,	,,	,,	,,	80	—
† Hopper Dredger	,,	,,	,,	400	500
† Gandia	,,	,,	,,	400	320

By Blackwood & Gordon, Port Glasgow.

† Alfred Dumois	—	Steam	-	737	700
Chicharra	—	Sail	—	252	—
Tortuga	—	,,	—	252	—
† Satellite	—	Steam	—	1,412	170
Llama	—	Barge	—	112	—
Carpinche	—	,,	—	112	—
† Iris	—	Steam	—	1,412	1,700
† Vauban	—	—	—	—	1,050
† Strathavon	—	—	—	—	1,500

By Hawthorns & Co., Leith.

No. 35 Devonport	Steel	Steam	British	—	350
No. 36 Devonport	,,	,,	,,	—	350
Commodore	,,	,,	,,	—	310
2 Lighters	,,	,,	Foreign	120 ea	—
Premier	,,	,,	British	—	310

By Abercorn Shipbuilding Co., Paisley.

	Steel	Steam	Foreign	742	600

By Mackie & Thompson, Govan, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Persia	Steel	Steam	British	1,850	1,100
† Alcestis	,,	,,	,,	1,850	1,100
† Bosnian	,,	,,	,,	336	625
† Corsican	,,	,,	,,	336	625
† Highland Lassie	,,	,,	,,	2,536	1,250
• Wasp	Iron	,,	,,	149	400
• Hornet	,,	,,	,,	149	400
† Zodiac	,,	,,	,,	149	350
† Pisces	,,	,,	,,	149	350
• Midge	,,	,,	,,	149	400
• Mosquito	,,	,,	,,	149	400

By Seath & Co., Rutherglen, Glasgow.

† Hippolyte Dumois	Steel	Steam	Foreign	681	700
Alexandria	,,	,,	,,	525	450
• Harrow	,,	,,	,,	40	120
Hilda	,,	Elect.	British	40	10
Flo	,,	,,	,,	40	10
Magregor	,,	,,	,,	40	10
Theodore	,,	,,	,,	40	10
Gulvo	,,	,,	,,	40	10
Barges	,,	Sail	,,	360	—

By D. & W. Henderson & Co., Meadowside, Partick, Glasgow

6 Barges	Steel	Sail	British	222	—
† Bellagio	,,	Steam	,,	3,919	2,500
† Brazilian	,,	,,	,,	3,203	2,500
Mosquito	,,	Sail	,,	240	—
Avispa	,,	,,	,,	240	—
Hormiga	,,	,,	,,	240	—
Arana	,,	,,	,,	240	—
† Scindia	,,	Steam	,,	4,358	3,000
France	,,	Sail	Foreign	3,784	—
† Mongolian	,,	Steam	British	4,750	3,500

By David J. Dunlop & Co., Inch Works, Port-Glasgow.

Francisco Vidiella	Steel	Steam	Foreign	460	475
Yres Amigos	,,	Lightr	,,	100	—
Cyrnos	,,	Steam	,,	1,040	1,450
Kallatina	,,	,,	,,	650	700
William Flower	,,	S. T.	British	55	200

By Grangemouth Dockyard Co., Grangemouth and Alloa.

† Ethil	Steel	Steam	British	1,784	1,200
† Anda	,,	,,	Foreign	728	560
† Mexicano	,,	,,	,,	479	650
Bankburn	,,	Sail	British	1,427	—
† Simon Dumois	,,	Steam	Foreign	730	730
† Banes	,,	,,	,,	765	730
† Managua	,,	,,	,,	730	730
† Georg Dumois	,,	,,	,,	765	730
Danube	,,	Sail	British	1,457	—
• Moss Rose	,,	Steam	,,	371	420
Zambese	,,	Sail	Foreign	389	—
† Voltaire	,,	Steam	British	450	420
• Jessie	,,	,,	,,	392	420
Orbis	,,	Sail	Foreign	1,620	—
Emin Pascha	,,	,,	,,	1,620	—
† Jose Romano	,,	Steam	,,	485	650
† River Steamer	,,	S.T.S.	British	270	200
† Duke of Portland	,,	Steam	,,	1,600	1,200
† Albert Dumois	,,	,,	Foreign	1,100	1,200
Tordenskjold	,,	Sail	,,	1,200	—

By the Fairfield Shipbuilding & Engineering Co., Limited, Govan, Glasgow.

Normannia	Steel	Steam	Foreign	8,249	16,000
Dunothar Castle	,,	,,	British	5,465	7,300
Adder	,,	,,	,,	976	5,300
Somdetch Phra Nang	,,	,,	,,	1,652	1,800
Phra Nang	,,	,,	,,	1,604	1.750
Darmstadt	,,	,,	Foreign	5,245	3,300
Gera	,,	,,	,,	5,257	3.250
Oldenburg	,,	,,	,,	5,257	3.250

By Murdoch & Murray, Port-Glasgow.

Name of Vessel.	Built of	Class.	Owners	G. T. Regis	H.P. I.
† Roseneath	Steel	Steam	British	1,779	1,180
† Pelcomayo ..	,,	,,	,,	433	340
† Rio Paraguay ..	,,	,,	,,	433	340
† Holgrein	,,	,,	Foreign	829	1,100
† Geerly	,,	,,	,,	829	1,100
† Taranaca	,,	,,	,,	301	340
Barge for Shipment	,,	Sail	,,	20	—

By R. Napier & Sons, Lancefield, Glasgow.

† Thames	Steel	Steam	British	5,600	7,000
† Clyde	,,	,,	,,	5,600	7,000

By Charles Connell & Co., Scotstown Shipbuilding Yard, Whiteinch, Glasgow.

Banda	Steel	Stean	Foreig	3,019	2,010
Grimm	,,	,,	,,	2,599	1,400
Stubbenhak ..	,,	,,	,,	2,943	1,680
Martin Saneny ..	,,	,,	,,	3,573	2,200
Melete	,,	Sail	,,	1,782	—
Iverna ..	,,	,,	,,	2,311	—
Erato	,,	,,	,,	1,782	—

IRISH.

By Charles J. Bigger, Londonderry.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Parkmore	Steel	Steam	British	3,318	—
Hawksdale ..	,,	Sail	,,	1,825	—
Foyledale	,,	,,	,,	1,765	—
Airesdale	Wood	,,	,,	1,825	—
Dimsdale	Steel	,,	,,	1,860	—

By Paul Rodgers & Co., Carrickfergus.

Creek Fisher ..	Steel	Sail	British	144	—
Shoal Fisher ..	,,	,,	,,	132	—
Clarissa	Wood	,,	,,	18	—
Anglesey	Steel	Steam	,,	120	—

By Harland & Wolff, Limited, Queen's Island, Belfast.

Name of Vessel.	Built of	Class	Owners.	G.T. Regis	H.P. I.
† Alexander Elder ..	Steel	Steam	British	4,173	1,950
† Saint Pancras ..	,,	,,	,,	4,282	1,950
California	,,	Sail	,,	3,099	—
† Imaum	,,	Steam	,,	4,128	2,300
† Michigan	,,	,,	,,	3,721	1,950
† Plassey	,,	,,	,,	3,176	1,500
† Columbian ..	,,	,,	,,	5,088	2,500
† Georgian	,,	,,	,,	5,088	2,500
† Mississippi ..	,,	,,	,,	3,731	1,950
† Sobraon	,,	,,	,,	3,185	1,500
† Memphis	,,	,,	,,	3,190	1,500
† Ernesto	,,	,,	Foreign	2,572	1,500
† British Crown ..	,,	,,	British	3,200	1,600

By Macilwaine & Maccoll, Limited, Belfast.

Lake Fisher ..	Steel	Sail	British	289	—
Minnie Hinde ..	,,	Steam	,,	540	700
Strait Fisher ..	,,	,,	,,	464	650
Glenarm	,,	,,	,,	523	700
Susannah Kelly ..	,,	,,	,,	289	300

By Workman, Clark & Co., Limited, Belfast.

† City of Dundee ..	Steel	Steam	British	3,427	2,000
† Chichester ..	,,	,,	,,	2,083	1,450
* Utra-sra-del-Carmen ..	Iron	,,	Foreign	306	400
* Marlay	Steel	,,	British	798	980
† City of Perth ..	,,	,,	,,	3,426	2,000
† Ethelwold	,,	,,	,,	956	940
Celtic King ..	,,	,,	,,	3,700	2,200
* Helen Craig ..	,,	,,	,,	420	540
† Eveleen	,,	,,	,,	500	700
No. 4 Ferry ..	,,	,,	,,	15	25

FRENCH.

By La Cie Des Messageries Maritimes, La Ciotat.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Polynésien ..	Steel	Steam	French	6,483	7,000

By La Ste. Anonyme Des Chantiers et Ateliers de la Gironde, Bordeaux.

† Corpilleurs 142, 143, 144	Steel	Steam	French	35	500
* Abenrach	,,	,,	,,	75	170

By L'Anonyme des Chantiers et Ateliers De La Loire, St. Nazare.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Corsica	Steel	Stean	French	3,076	1,450
† Colombia	,,	,,	,,	3,076	1,450
† Chishuua Kan ..	,,	,,	Japan	750	4,800

DUTCH.

By Royal Shipbuilding & Engineering Co., De Schelde, Flushing.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	H.P. N.
† Reael	Iron	Steam	Holland	1,294	250
† Coen	,,	,,	,,	1,298	250
† Mackuyeker ..	,,	,,	,,	1,326	250

By Nederlandshe Stoomboot Maatschappy, Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† De Carpentier ..	Steel	Steam	K. P. M.	740	1,250
† Zeeduif	Composite	,,	Dutch	148	400
† Van Diemen ..	Steel	,,	K. P. M.	740	1,250

By De Maas, Delasshaven, near Rotterdam.

† Reynieraz	Steel	Steam	Dutch	644	550

By De Koninklyke Fabrick Von Stoom-enandre Werktingen, Amsterdam.

† Vangoens	Iron	Steam	Dutch	1,006	800
† Speilman	Steel	,,	,,	1,006	800
† Sumatra	,,	,,	,,	1,700	3,500

ITALIAN.

By Poli Brothers, Chioggia (Venice).

Name of Vessel.	Built of	Class	Owners.	G T Regis.	H P. 1.
Hopper Barge No. 4	Steel	Stean	Italian	198	250
Hopper Barge No 7	,,	,,	,,	198	250
Two Gunboats ..	,,	,,	,,	25	60

NORWAY.

By Bergen Mekaniska Verkstuls A.B., Bergen.

Name of Vessel.	Built of.	Class.	Owners.	G.T. Regis.	H.P. N.
† Urda	Steel	S. S.	Norway	700	100
† Breidablik ..	,,	,,	,,	700	100
† Washington ..	,,	,,	,,	630	75

By Laxwaags Shipbuilding & Engineering Co., Bergen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Drot	Iron&Steel	Steam	Norway	1,970	220

By Laxwaags Shipbuilding & Eggikeering Co., Bergen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Skomvor	Steel	Sail	Norway	1,687	—
† Britannia	Iron	Steam	"	941	3,000
* Bergen	Steel	Ferry	"	40	60

SWEDEN.

By Kockams Mekaniska Werkstad, Malmo.

Name of Vessel.	Built of	Class.	Owners.	G T Regis.	H.P. N.
* Ermeland	Steel	Steam	German	423	70
* Kockum	"	"	Russian	495	90
* Albrektsund	"	"	Sweden	225	65
* Middelgrunden	"	"	Denmrk	39	30
† Frans	"	"	Sweden	614	100
† Havornen	"	"	Denmrk	75	40
* Falken	"	"	"	75	40

By Motala Mekaniska Werkstad, A.B., Motala.

† Blesk	Steel	Steam	Russian	2,868·35	300
† Baron Stjernblad	"	"	Danish	1,038·87	140
† Tyr	"	"	"	790·20	120
* Sokimanic	"	"	Russian	596·58	70
* Thor in breaker	"	"	Danish	659·20	140
† Silach	"	"	Russian	499·17	250
† Ledskol	"	"	"	487·89	140
† A Wuander	"	"	Sweden	1,000	140
* Gotha	"	"	"	3,100	800
† Aron	"	"	"	414·42	70
* Undine	"	"	"	50·50	30
* Hamid	"	"	Russian	538·65	80
* Aga Dadascheff	"	"	"	541·22	90
* From	"	"	Danish	108·26	60
* Gustafsfors IV.	"	"	Sweden	40·24	25
* Inzenior	"	"	Russian	99·35	35
* Falken	"	"	Sweden	96.53	35
* Gotr Kanal VI.	"	"	"	159·67	30

By Sora Varfvet, Stockholm, Sweden.

* Anthrae	Steel	Steam	Sweden	125	30
* Giman	"	"	"	150	40
† August	"	"	"	670$\frac{55}{100}$	100
* Eskilstuna	"	"	"	215	50
* Attu	"	"	Foreign	100	20
* Eos	"	"	Sweden	20	5
* Waxholm	"	"	"	20	5

GERMAN.

By J. W. Klawitter, Danzig.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis	H.P N.
* Hela	Steel	Steam	German	330	50
† Courier	"	"	"	135	65
* Juno	"	"	"	42	20
* Stadt Fürstenberg	"	"	"	135	75
* Kaiser Wilhelm II.	"	"	"	125	40

By Schiffswerft Von Henry Koch, Lübeck.

Anna Ramien	Steel	Sail	German	1,320	—
Sterna	"	"	"	1,430	—
* Stecknitz	"	Steam	"	—	15

By Schiff und Maschenbau, Actien Gesellschaft, Germania Kiel.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H P.
† Meteor	Steel	Steam	German	688	5,000
† S. 40	"	"	Ottom'n Govmnt	140	2,500
* Hnsum	"	"	German	268	150

By Bremer Schiffsbaugesellschaft, Vegesack.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Hainau	Steel	Steam	German	1,043	500
* Wodan	"	"	"	90	300
‡ Nereïde	"	Sail	"	1,840	—
J. C. Glade	"	"	"	1,488	—
* Paris	"	Steam	Foreign	10	22

"Howaldtswerke," Kiel.

* Greif	Steel	Steam	German	11	22
† Sieglinde	"	"	"	996	380
† Portugal	"	"	"	1,022	400
† Hans	"	"	"	1,027	450
† Theodor	"	"	"	938	400
* Fliege	"	"	"	29	65
† Tila	"	"	Foreign	381	420
* Holstein	"	"	German	52	65
* Georg	"	"	"	62	65
† Helene	"	"	"	707	350
† Marie	"	"	"	882	400
† Lensalm	"	"	"	99	250
* Gossler	"	"	"	64	80
* Steinmann	"	"	"	64	80
† Setubal	"	"	"	1.020	400
† Senior	"	"	"	994	380
† Bertha	"	"	"	710	380
* Adler	"	"	"	28	65
* Bussard	"	"	"	28	65
* Eisvogel	"	"	"	28	65
* Two Barges	"	"	"	170	—
* Nauta	"	"	Foreign	326	160

By Flensburger Schiffsbau Gesellschaft, Flensburg.

† Desdemona	Steel	Steam	German	2,745	1,600
† Mira	"	"	"	962	500
† Hektos	"	"	"	1,174	550
† Concurrent	"	"	"	845	350
† Tai-yick	"	"	"	1,428	650
† Lesbos	"	"	"	1,778	750
† Rhodos	"	"	"	1.778	750
† Samos	"	"	"	1,786	750
† Schönburg	"	"	"	1,846	1,100
† Löwenburg	"	"	"	1,847	1,100

By Reiherstieg Schiffswerfte und Maschienen Fabrik, Hamburg.

† Paraguassu	Steel	Steam	German	2,800	1,800
† Herodos	"	"	"	2,600	1,500
† Patagonia	"	"	"	3,200	2,000
* Kohlbrand	"	"	"	120	200
Lighter No. 1	"	"	"	500	—
Lighter No. 2	"	"	"	500	—
* R. Sc. M. No. 2	"	"	"	—	50

By Gebruder Sachsenberg Rosslau, Elbe.

† Hohenzollern	Iron	Pad'le	German	420	600
* Graf Moltke	"	Screw	"	40	110
* Fürst Bismarck	"	Pad'le	"	120	240
† Mathias Stinnes VI.	"	"	"	520	800
* Lageada	Steel	"	Brazil	40	100
† Pereinigte Schiffer XII.	Iron	"	German	440	600
† Kaiser Friedrich	"	"	"	120	240
* Dresden	"	"	"	430	600
Harmonie	"	"	"	120	240
* Franzuis	"	"	"	90	150
* Günther	"	Sail	"	840	—
Thimmig	"	"	Brazil	36	—

By Rostocker Actien Gesellschaft, Rostock.

* Minna Horn	—	Steam	German	699	350
† Hermann	—	"	"	977	400
* Carl Behuck	—	"	"	667	350
† Imperial	—	"	"	953	400
* Agnes	—	"	"	727	350
† Britannia	—	"	"	959	400
Artemis	—	Sail	"	1.479	—
‡ Maribo	—	Tug	"	30	—
* Minna	—	Steam	"	192	250
* Jacoba	—	"	"	480	300

AUSTRIAN.

By Stabilimento Tecnico, Trieste

Name of Vessel.	Built of	Class	Owners.	G.T Regis.	H.P. N.
† Trabant	Steel	Steam	Austria	576	1,000
† Pola	,,	,,	,,	185	60
* Umberto	,,	,,	Italian	40	20
* Bojana	,,	,,	Austria	202	25
† San Ginsto	,,	,,	,,	1,900	160
† Viktoria	,,	,,	Russian	414	60
* Aidin	,,	,,	Turkish	66	40
* Archipel	,,	,,	,,	65	40
* Sofia Cuppa	,,	,,	Russian	385	60

BELGIUM.

By Societe John Cockerill, Hoboken.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† John Cockerell	Steel	Steam	Belgium	—	1,600
Ville d'Anvets	,,	,,	Foreign	—	—
PrincessClementina	,,	,,	,,	—	—
Arch. Stephanie	,,	,,	,,	—	—
Ville de Bouges	,,	,,	,,	—	—
La Deliverance	,,	,,	,,	—	60
Ville d'Ostend	,,	,,	,,	—	20
2 Barges	—	,,	,,	—	—
2 Hopper Barges	—	—	,,	200	—
30 Boats	—	—	,,	—	—

DANISH.

By Elsinore Iron Shipbuilding & Engineering Co., Elsinore.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Hamlet	Steel	Steam	Danish	1,109	570
* Mjolner	,,	,,	,,	497	1,200
* Maja	,,	,,	,,	390	250
† Nordvest	,,	,,	,,	1,625	750
* Narskopping	,,	,,	German	660	480
* Ella	,,	,,	Danish	390	250
† C. F. Grave	,,	,,	,,	231	350
† Trensburg	,,	,,	German	1,776	1,200
† Marxburg	,,	,,	,,	1,776	1,200
By Burmeisler & Wains, Copenhagen.					
* Tydskland	Steel	Steam	Danish	670	250
* Rusland	,,	,,	,,	854	300
† Christine	,,	,,	,,	2,292	1,000
† Olnf Bager	,,	,,	,,	357	400
† Fiona	,,	,,	,,	357	500
† Tejo	,,	,,	,,	820	500

SPANISH.

By Martinez Rivas & Palmer, Nerviou, near Bilbao

Name of Vessel.	Built of	Class.	Owners.	Dis-place.	H.P. I.
† Infanta Maria Teresa	Steel	Steam	Spanish Govmnt	7,000 tons	13,000

FINLAND.

By Wm. Crichton & Co., Aktiebolaz, Abo.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Hogland	Steel	Steam	Russian	160	450
† Nargo	,,	,,	,,	160	450
† Borgu	,,	,,	,,	130	300
† Skenis	,,	,,	,,	130	300
† Sifidrud	,,	,,	,,	36	25
* Tifsula	,,	,,	Finland	42	15
† Torpedo boat	,,	,,	Russian	129	250
† Torpedo boat	,,	,,	,,	129	250
1 Water barge	Iron	—	,,	50	—
1 Barge	Wood	—	,,	—	—

Summary of Shipbuilding Returns of United Kingdom in 1890 arranged in order of Tonnage built by each Firm.

	Name of Firm	Place.	No. of Ships	Total Tons.
1	Russell & Co.	Clyde	34	70,370
2	Wm. Gray & Co.	Hartlepool	27	64,253
3	Harland & Wolff	Belfast	13	48,633
4	Palmers' Shipbuilding Co.	Tyne	14	45,312
5	Raylton Dixon & Co.	Tees	20	43,665
6	Fairfield Shipbuilding Co.	Clyde	8	33,705
7	Ropner & Sons	Tees	12	32,662
8	J. L. Thompson & Sons	Wear	14	32,040
9	Wm. Doxford & Sons	Wear	9	28,386
10	Sir Wm. Armstrong, Mitchell & Co.	Tyne	13	28,110
11	C. S. Swan & Hunter	Tyne	11	26,454
12	Edward Withy & Co.	Hartlepool	11	26,024
13	Short Bros.	Wear	11	25,073
14	Richardson, Duck & Co.	Tees	11	24,711
15	Naval Construction & A. Co.	Barrow	6	24,665
16	J. Readhead & Sons	Tyne	11	23,599
17	Wm. Denny & Bros.	Clyde	9	23,429
18	James Laing	Wear	9	22,701
19	D. & W. Henderson & Co.	Clyde	9	20,974
20	R. & W. Hawthorn, Leslie & Co., Limited	Tyne	9	19,688
21	Barclay, Curle & Co.	Clyde	7	19,496
22	Tyne Iron Shipbuilding Co.	Tyne	8	18 016
23	Chas Connell & Co.	Clyde	7	18,012
24	A. Stephen & Sons	Clyde	7	16,841
25	Caird & Co.	Clyde	5	16,318
26	R. Stephenson & Co.	Tyne	5	15,795
27	Sunderland Shipbuilding Co.	Wear	6	15,715
28	Workman, Clark & Co.	Belfast	10	15,631
29	Craig, Taylor & Co.	Tees	8	15,398
30	J. & G. Thomson	Clyde	7	14,800
31	Wigham, Richardson & Co.	Tyne	8	14,523
32	W. Pickersgill & Sons	Wear	5	12,223
33	Gourlay Brothers	Dundee	5	11,616
34	A. & J. Inglis	Clyde	7	11,554
35	John Blumer & Co.	Wear	8	11,270
36	R. Thompson & Sons	Wear	5	11,261
37	R. Napier & Sons	Clyde	2	11,200
38	Thos. Roydon & Sons	Mersey	4	11,045
39	Chas. J. Biggar	Londonderry	5	10,593
40	John Priestman & Co.	Wear	6	10,478
41	Edwards' Shipbuilding Co.	Tyne	6	10,450
42	W. Dobson & Co.	Tyne	7	10,438
43	R. Duncan & Co.	Clyde	6	10,290
44	Wood, Skinner & Co.	Tyne	10	10,065
45	Bartram, Haswell & Co.	Wear	4	10,013
46	Laird Bros.	Mersey	7	9,168
47	Turnbull & Sons	Whitby	4	8,682
48	Ramage & Ferguson	Leith	6	8,584
49	W. B. Thompson & Co.	Dundee	8	8,463
50	Schlesinger, Davis & Co.	Tyne	3	7,866
51	Blyth Shipbuilding Co.	Blyth	6	7,259
52	W. H. Potter & Sons	Mersey	3	6,341
53	Osbourne, Graham & Co.	Wear	4	6,098
54	S. P. Austin & Co.	Wear	3	5,978
55	Hall, Russell & Co.	Aberdeen	8	5,684
56	Napier, Shanks, & Bell	Clyde	4	5,616
57	R. Craggs & Sons	Tees	5	5,554
58	A. McMillan & Sons	Clyde	4	5,280
59	Murdoch and Murray	Clyde	6	4,604
60	Earle's Shipbuilding Co.	Humber	9	4,429
61	Strand Slipway Co.	Wear	3	3,129
62	Cook, Welton & Gemmell	Hull	17	2,577
63	T. &. W. Smith	Tyne	3	2,356
64	D. J. Dunlop & Co.	Clyde	5	2,305
65	Macilwaine & MacColl, Ld.	Belfast	5	2,105
66	Scott & Co.	Clyde	5	1,970
67	John Reid & Co.	Clyde	3	1,128

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from November 25th to December 22nd, 1890:—

Andrews, Harry G., engineer to the *Sirus*, to date November 29th.

Bourke, Henry G., fleet engineer to the *Hero*, to date November 26th.

Bramsden, W. H., chief engineer to the *Asia*, additional, to date December 8th.

Brown, James, engineer (temporary service) to the *Assistance*.

Bryant, G. Little, engineer to the *Tyne*, to date November 26th.

Colquhoun, Peter, fleet engineer to the *Asia*, additional, to date November 26th.

Duffell, Wm. J. (probationary), assistant engineer to the *Anson*, to date December 2nd.

Dupen, Arthur P. L. (probationary), assistant engineer to the *Indus*, additional, for Mildura, to date December 2nd.

George, F. T., engineer to the *Sans Pareil*, to date December 9th.

Hawkins, Fredk. Wm., chief engineer to the *Nymphe*, to date November 15th.

Hull, Wm., engineer to the *Triton* (for temporary duty), to date November 26th.

Hunter, Robt. A., assistant engineer to the *Asia*, additional, for Karra Katta, to date December 2nd.

Kerswell, Geo. T., engineer to the *Seagull*, to date December 1st.

Milton, Wm., engineer to the *Rattlesnake*, to date December 1st.

Pounds, T. H., assistant engineer to the *Belleisle*, to date December 9th.

Price, John F., engineer to the *Tyne*, to date December 9th.

Slade, Allan H., engineer to the *Blake*, to date November 29th.

Stevens, John G., engineer to the *Seagull*, to date December 1st.

Taylor, Harry, chief engineer to the *Hearty*, to date December 1st.

Thorne, Thomas, chief engineer to the *Indus*, additional, to date November 10th.

Tregenna, Richd. H., staff engineer to the *Calypso*, to date December 12th.

Watch, John J., chief engineer to the *Pembroke*, additional, for the *Apollo*, to date December 1st.

Weeks, Geo. J., fleet engineer to the *Audacious*, to date November 27th.

HOAR & BROWN'S LONDON HARDWOOD MARKET REPORT, Dec. 23rd, 1890.

TEAK.—The deliveries for the past three weeks have been 1,373 loads.

The market has been considerably strengthened by these large deliveries, coupled with the fact that the British Admiralty are inviting tenders for over 5,000 loads of timber to be supplied during the coming year.

Enquiries are somewhat quiet, as is generally the case at this season of the year.

With regard to the future, the disturbing feature is the quantity of Bangkok timber afloat, which, no doubt, will have to be landed here, unless sold for other ports previous to arrival.

The quantity of Rangoon and Moulmein afloat is unusually small, and shippers are showing a wise discretion in restricting shipments.

With the turn of the year it is anticipated that business will be brisker than of late.

MAHOGANY.—The eagerness displayed during the present month to secure parcels has had the effect of forcing up prices still higher, and it is expected that the top is by no means reached yet. Considering that dealers are holding very little stock indeed, and are unable to secure their requirements, this view may well be entertained.

Her Majesty's War Office Department have come strongly into the market for Tobasco, causing the only cargo left to be quickly taken up, thus leaving only one cargo of Southern wood for the open market.

Spa[illegible] and small Cuba stocks have now eased off consider- [illegible]ered the atmosphere of a drug which held quota- [illegible]inimum classes

Prices are expected to hold firm for the coming season's importations.

CEDAR.—In consequence of a spurt, purchases have been made of stock here and afloat, these again changing hands and going into consumption, thereby causing excitement sufficient to drive up values a point or two.

The cargo of Bastard Cedar referred to last month has been taken up at a low figure, and appears to be finding buyers, being used, no doubt, to fill the place of mahogany, on account of the present high price of the latter.

AMERICAN SAWN WALNUT AND WHITEWOOD.—Sales have been made upon a rather extensive scale, in consideration of prices being forced down by "without reserve" sales.

Stocks are very heavy, and with a further prospect of speculative consignments being destined to the hammer, the outlook is far from promising.

A fair trade has been done in whitewood logs.

WALNUT LOGS.—There is plenty of opening for wood of good description, and some remunerative business has been transacted in special sizes of prime quality, high figures being readily obtained.

Inferior wood has also improved, and considerable business has resulted.

OAK PLANKS AND BOARDS.—Large parcels are being offered extremely low, but business is very quiet, and prices are not likely to improve.

GREENHEART.—No change to report.

KAURIE PINE.—The market is fairly good, as was shown at the last forced public sale, and there is a possibility of this wood coming more into notoriety.

PADOUK.—Some inferior stock was sold at public sale at low prices. For the better class qualities there still continues a steady demand.

SEQUOIA.—A quietness prevails over this stock, very few enquiries being about.

QUEBEC YELLOW PINE TIMBER.—The stock of first-class deck timber is very moderate, and, as no further arrivals can be looked for, prices will remain very firm, with a prospect of advancing.

OAK AND ELM.—The stock of oak is considerable, while that of elm is moderate; the demand for both being inactive.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE year now closed has been one of constant activity in the shipbuilding and marine engineering industries of the Clyde and other Scotch centres. This has been clearly shown by these monthly notes and by the accounts of launches and trial trips which have been so prominent a feature in each successive issue of this journal. Elsewhere, in the present number, will be found details of the work completed by the various firms, so that it is only necessary here to give total figures and general remarks. Altogether about 240 vessels, (excluding "small fry" and boats shipped in pieces), have been completed in the Clyde district during the year (200 steamers, and 40 sailing vessels) of an aggregate tonnage of about 340,000 tons (it is absurd to claim accuracy to a ton or two); 39 vessels aggregating 32,900 tons (32 steamers of 23,100 tons and 7 sailing ships of 7,800 tons) were launched on the Forth; 15 vessels aggregating 24,490 tons (13 steamers of 20,080 tons and 2 sailing vessels of 4,420 tons) were completed at Dundee, and 15 steamers aggregating 9,230 tons were turned out at Aberdeen.

In all the districts the twelvemonths' output is in excess of that for the year previous (on the Clyde alone the increase is as much as 15,000 tons), and takes rank amongst the very highest yearly total throughout the history of the industries. The work still on hand amounts to about 300,000 tons, all the districts being better off in this respect than they were at the corresponding period last year. The nature of the work on hand will have been gathered from this column from month to month, so that it is only needful here to comment on the character of the work completed. Over three-fourths of the number of vessels turned out were steamers, twelve of which were over 4,000 tons, one being the *Scott*, a Union liner of 7,000 tons, launched by Messrs. Denny Bros., of Dumbarton. Of the sailing vessels, one approached 4,000 tons, and 12 were four-masted in rig.

A large proportion of vessels launched during the year was, as is usually the case, for foreign owners. Germany, as in previous years, takes the lead with 13 vessels of about 45,000 tons, while Norway follows with the (for her) very large figures of 18 vessels of about 20,000. France had 8 vessels built of about 13,000 tons, while the tonnage ordered by all other countries was under 7,000 tons in each case.

Messrs. Russell & Co., as may well be supposed, again head the list of Clyde firms in the matter of output. Indeed their tonnage, the enormous figure of 70,370 tons, is by far the largest output of any firm's in the kingdom, the next highest being Messrs. William Gray & Co., West Hartlepool, with 64,000 tons, Messrs. Harland & Wolff, Belfast, with 48,000, and Palmers' Co., with 45,000 tons.

The total of this Clyde firm not only places it in this distinguished position, but establishes a record which will stand probably for a considerable number of years. The order in which the remaining output of the Clyde firms follow this remarkable figure is shown by the following table, which, for comparison, also gives the output for 1889:—

	1890.		1889.	
	Ves.	Tons.	Ves.	Tons.
Messrs. Russell & Co., Greenock	34	70,370	21	46,500
Fairfield Co., Govan	8	33,705	8	23,830
Messrs. Denny Bros., Dumbarton	9	23,429	20	25,320
Messrs. D. & W. Henderson, Part'k	9	20,974	17	11,806
Messrs. Barclay, Curle, & Co., Limited, Whiteinch	7	19,496	6	12,760
Messrs. Charles Connell & Co., Scotstoun	7	18,012	8	15,020
Messrs. A. Stephen & Sons, Linthouse	7	16,841	8	18,430
Messrs. Caird, Greenock	5	16,318	7	16,451
Messrs. Scott, Greenock	11	15,882	12	20,630
Messrs. James & George Thomson, Limited, Clydebank	7	14,800	3	12,316
Messrs. A. & J. Inglis, Pointhouse	7	11,554	3	8,304
Messrs. Robert Duncan & Co., Port-Glasgow	6	10,290	7	11,257
Messrs. Mackie & Thomson, Govan	11	7,882	5	2,215
Ailsa Co., Troon	7	6,004	7	3,771
Messrs. W. Hamilton & Co., Port-Glasgow	3	5,851	3	5,312
Messrs. R. Napier & Sons, Govan	2	11,200	3	11,640
Messrs. Napier, Shanks & Bell, Yoker	4	5,616	4	5,16
Messrs. A. M'Millan & Co., Limited, Dumbarton	4	5,280	7	10,344
Messrs. Fleming & Ferguson, Paisley	10	5,150	6	3,620
Messrs. Murdoch & Murray, Port-Glasgow	6	4,604	3	6,269
Messrs. Wm. Simons & Co., Renfrew	10	4,310	10	3,375
Messrs. Blackwood & Gordon, Port-Glasgow	6	4,209	2	800
London and Glasgow Co., Govan	2	3,600	3	8,666
Messrs. Lobnitz & Co., Renfrew	16	3,553	8	6,507
Messrs. Alley & M'Lellan, Polmadie	26	3,385	—	1,517
Campbeltown Co.	2	2,951	3	4,438
Messrs. M'Knight & Co., Ayr	5	2,510	5	4,554
Messrs. D. J. Dunlop & Co., Port-Glasgow	5	2,305	5	6,700
Messrs. Scott & Co., Bowling	5	1,970	5	2,054
Messrs. Fullerton & Co., Paisley	6	1,774	4	955
Messrs. T. B. Seath & Co., Rutherglen	11	1,646	7	527
Messrs. Jno. Reid & Co., Port-Glasgow	3	1,128	7	12,754
Messrs. Murray Bros., Dumbarton	7	1,104	—	—
Messrs. M'Arthur & Co., Paisley	5	906	5	752
Messrs. Darry & M'Kendrick, Govan	5	794	—	—
Abercorn Co., Paisley	1	742	1	86

The total I.H.P of the engines constructed by marine engineers in Scotland during the year was 397,778. Subjoined is an abstract of the returns:—

	1890.	1889.
	I.H.P.	I.H.P.
J. & G. Thomson, Ltd., Clydebank	44,300	20,000
Fairfield Co., Govan	53,950	29,750
W. Denny & Co., Dumbarton	37,850	22,730
Muir & Houston, Kinning Park	18,575	9,150
Dunsmuir & Jackson, Govan	17,450	16,431
Fleming & Ferguson, Paisley	17,150	8,600
W. B. Thompson, Limited, Dundee	14,150	—
J. & J. Thomson, Finnieston	14,100	17,380
Jas. Howden & Co., Glasgow	14,010	—
Caird & Co., Limited, Greenock	13,900	15,500
A. & J. Inglis, Pointhouse	13,810	6,700
Barclay, Curle & Co., Ltd., Stobcross	13,800	1,000
Gourley & Co., Dundee	13,200	—
Rowan & Sons, Finnieston	12,500	7,750
A. Stephen & Co., Linthouse	12,250	9,000
D. & W. Henderson, Meadowside	11,500	8,250
Hutson & Corbett, Kelvinhaugh	10,750	12,360
Bow & M'Lachlan, Paisley	10,275	7,145
Rankin & Blackmore, Greenock	8,300	6,400
Ramage & Ferguson, Leith	7,071	8,375
Scott & Co., Greenock	7,800	23,200
R. Napier & Sons, Govan	7,000	16,500
Blackwood & Gordon, Port-Glasgow	6,650	500
Ross & Duncan, Govan	6,212	4,675
Hall, Russell & Co., Aberdeen	6,080	—
Mr. Kemp, Govan	5,300	900
W. Simons & Co., Renfrew	5,240	3,100
D. J. Dunlop & Co., Port-Glasgow	2,825	3,690
John Scott & Co., Kinghorn	2,720	4,400
W. King & Co., Limited, Glasgow	2,700	240
London & Glasgow Co., Govan	2,800	6,700
Duncan Stewart & Co., Glasgow	2,300	850
John Duthie, Sons & Co., Aberdeen	2,150	—
Hawthorns & Co., Leith	2,020	500
A. Hall & Co., Aberdeen	1,580	—
Alley & M'Lellan, Glasgow	1,060	7,420
Hanna, Donald & Wilson, Paisley	1,050	900
	397,778	

As was the case in 1889, all the steamers constructed in Scotland during the past year were supplied with machinery from Scotch engineering establishments. In addition, however, quite a goodly amount of work was executed by various engineering firms for vessels built in England, the colonies, and in foreign countries.

Messrs. Russell & Co., of Greenock and Port-Glasgow, have, as usual, their three yards in full activity, and continue to book orders with astonishing frequency. During December month they have launched five vessels of an aggregate of about 11,000 tons, and have booked new tonnage considerably in excess of that figure. The new work includes a steel sailing ship of 1,700 tons register, and 2,870 tons deadweight, for Messrs. Roberts, Rodgers & Co., Liverpool; a sailing ship of 1,700 tons for Messrs. G. T. Soley & Co., Liverpool; four steel twin-screw triple-expansion steamers, each 300 tons, for the Amazon Steam Navigation Co., the engines for which will be 500 H.P., and will be supplied by a Greenock firm; a steel sailing barque, 1,500 tons register, for Mr. T. Stray, of Christiansand; and a four-masted steel sailing ship of 2,600 tons register, for Messrs. David Bruce & Co., Dundee.

Messrs. Wm. Hamilton & Co., of Port-Glasgow, have contracted to build a large steel sailing ship of 2,150 tons register, for Messrs. Potter Bros., London, and a second ship of about the same tonnage for Glasgow owners.

Messrs. Caird & Co., Greenock, have been commissioned by Messrs. G. & J. Burns, of Glasgow, to build a large screw steamer for their Belfast trade. The new vessel will have no provision for passengers, being mainly intended for carrying iron, sugar, and rough cargo of all kinds.

Messrs. McArthur & Co., shipbuilders, of Paisley, have contracted with Messrs. John Inglis & Co., of Glasgow, acting on behalf of the Union Steamship Co., of British Columbia, Vancouver, for two screw steamers of 300 tons each, for quick delivery. The engines for these vessels are to be made by Messrs. Bow & McLauchlin, of Paisley. The hulls are to be of steel, built in sections convenient for shipment. It is understood that these steamers are forerunners of several vessels of the same type for employment between Vancouver City and adjacent ports in British Columbia.

Messrs. Fleming & Ferguson, Paisley, continue busy supplying their patent quadruple-expansion engines to new vessels, and to old vessels, in which they take the place of the now obsolete compound engines. A recent instance of the saving effected by the new type of machinery is found in the s.s. *Erling*, which was tried on the Clyde on 6th December. This vessel, with 1,200 tons on board, gave a good account of herself, and proved that she could steam 9 knots on a consumpt. of 8 tons per day, while formerly her performances never much exceeded 7 knots even with a consumpt. of 15 tons per day—nearly double.

Messrs. Napier, Shanks, & Bell, of Yoker, early in the month instituted severe tests of a vessel they have built, which has on her main deck a set of powerful sheerlegs constructed by Messrs. George Russell & Co., of Motherwell. The vessel is intended for carrying guns and other heavy material. The sheers are on Messrs. George Russell & Co.'s patent principle, having the main screw inside the back leg. They are capable of lifting a load of 60 tons from the centre of the hold, and delivering it 15 ft. beyond the side of the vessel on a wharf or another vessel. The test was one of the old boilers from the Anchor Liner *Furnessia* loaded up to the required weight. The "heel," or list over of the vessel, with the 60 tons overhung, was found to correspond exactly with the shipbuilders' calculations, and altogether the test was satisfactory to all interested.

The *Thetis*, the second of the three second-class protected cruisers which Messrs. G. & J. Thomson, Clydebank, have on hand for Her Majesty's Government, was launched on the 13th ult. from the Clydebank yard. Her tonnage is 3,400 tons; her speed will be from 18 to 20 knots, and she will be able to carry a coal supply at load draught that will enable her to maintain a speed of 10 knots for a distance of 1,000 knots. Her defensive armament will be of the most powerful character, and she will be amply protected against the attack of an enemy by an armoured breastwork and compound steel armour plates. The total number of vessels launched from this renowned yard, it may be stated, are valued at more that eight millions.

The Ferries Committee of the Clyde Trust have been empowered to add a new steam ferry-boat to the number of existing steam-ferries engaged in cross-river service in the harbour of Glasgow. The new boat is to be employed between Whiteinch on the north side and Linthouse on the south, this being the furthest down-river station of any of the existing ferries. The committee have also been authorised to accelerate the service of passenger steamers—the *Cluthas*—up and down the harbour by means of two new vessels. The new steamers, it is said, will be carefully designed, and from the experience with the boats now in use they will likely be more perfectly adapted to the traffic.

Assured success—long worked for and well deserved—now attends the application of forced draught to steamers on the system introduced and perfected by Mr. James Howden of Glasgow. As an instance of this I may mention that during *one week* last month as many as five steamers were tried for speed on the Firth of Clyde, in each of which the boilers were worked under Howden's system. These were the *Virawa* and *Amra*, of the British India Steam Navigation Co.; the *Utopia*, of the Anchor Line; the *Indiana*, of the International Steamship Co., and the *Wasp*, a small steamer by Messrs. Muir & Houston.

Messrs. Howden & Co.'s large works in Scotland Street are at present, and have been for a long time past, taxed to their utmost in the production of propelling machinery in which forced draught is a leading feature, and I understand that the "Atlantic greyhound," *City of Paris*, is now in the hands of Messrs. Howden & Co. for its complete equipment with their forced draught system—surely in itself a conclusive testimony to the success with which it has been attended in smaller vessels. This, however, is still better borne out by another fact which has come to my knowledge, that in addition to Messrs. Howden & Co.'s own contracts during 1890, other engineers and shipbuilders have completed, or have in hand, no less than 42 steamers, fitted, or to be fitted, under license from Messrs. Howden & Co., with their system of forced draught, having an aggregate of 86,360 I.H.P. Some very large applications of Howden's system are besides under negotiation.

At Ardrossan trade matters are in a somewhat depressed state. The operations at the new docks have been very seriously retarded of late; indeed much upset by inundations of the sea. The bad formation of the roadway between the old dock and the new outer basin has contributed to this. The new quay wall was being founded to a great depth on the south side of the dock, and being carried round to the old Belfast pier, but the water found a way through the rubble or subsoil into the new outer basin workings, and practically stopped progress for the season, when somewhat over 24 per cent. of the work had been gone through in the outer basin, and 51 per cent. of that in the entrance channel, 97 per cent. of the concrete walls inside the coffer dam, and about 52 per cent. of the works at the breakwater. The additions since have not been extensive, and now all the floating gear, except one dredge, has been laid up for the winter, and 120 hands have been paid off. The foundry of Messrs. Goodwin & Co. has always been the leading industry in Ardrossan, and afforded work to many hands, a large diminution in the number of whom is about to take place. The Grangemouth Dockyard Co., who have leased the shipyard here, have not yet begun operations on any vessels, and the shipyard hands have all meantime been paid off.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The prosperous state of business which was apparent at all the principal shipbuilding establishments at the beginning of the year has not been maintained throughout the whole twelve months, and though in the autumn a temporary stimulus was given to the industry by the accession of a number of new orders, which were mostly of a speculative character, it must be confessed that at the close of the year matters, from the business point of view, are not so bright as at its opening. In 1888 the tonnage launched on the north-east coast reached the large total of 514,547 tons, and this figure was exceeded in 1889 by 225,081 tons, making the total for the latter year 739,628 tons. This, of course, was a long way above the normal output, and it was quite clear to all practical minds that it could not be maintained for any lengthened period. It will not be matter for surprise, therefore, that this year's returns show a considerable falling off in the output, and that the probability of a further and much larger decrease next year has to be faced by those interested. For some exceptional reasons, that part of the north-east district which comprises Stockton, Middlesbrough, and the Hartlepools, has not participated in the backward movement, but has, on the contrary, gone still higher up in the records of output returns. This circumstance materially lessens the effect of the declension on the Tyne and Wear, though it does not alter the fact that, taken as a whole, the volume of trade in 1890 has sensibly diminished, as compared with 1889. The subjoined figures will show at a glance the exact state of matters as regards the tonnage launched at the different centres indicated during 1890 and 1889 respectively:—

	1890.	1889.	Decrease.
Tyne	234,000	281,710	47,710
Wear	196,907	217,336	20,429
Blyth	10,972	7,337	3,595
			Increase.
Tees	127,739	110,429	17,310
Hartlepools	99,847	84,109	15,738

From the foregoing it will be seen that though at the Hartlepools and the Tees centres there has been an increase of 33,048 tons launched in 1890 as compared with 1889, there has on the Tyne (including Blyth) and the Wear been a decrease of 71,734 tons, thus making an actual decrease for the whole of the centres dealt with of 38,686 tons. The Tyne decrease of 47,710 tons would scarcely have been so large but for the fact that a great proportion of the work in hand this year consisted of war vessels, which, as is well known to practical men, take a much longer time in building than ordinary cargo or passenger vessels. From the Elswick yard four vessels of this class, having an aggregate tonnage of 6,077 tons and a total H.P. of 34,500, were launched during the year, and in addition to these the Palmer's Co., Messrs. Hawthorn, Leslie & Co., and Messrs R. Stephenson & Co., launched one such vessel each, the aggregate tonnage amounting to 7,050 tons, and the H.P. to 24,000. The whole of these war vessels were British, excepting one (the "25th de Mayo") which was built for the Argentine Republic. In passenger and cargo vessels a good deal of work has come to the Tyne this year from foreign countries and from our colonial dependencies. The vessels that may be included under the two latter heads amount to no less than 44 in number, with an aggregate tonnage of 83,160 tons, or considerably more than one-third of the whole tonnage launched in the twelve months. The colonial contribution to this great total amounted to less than 3,000, so that independently of the work done for the colonies, it can be said with perfect accuracy that more than one-third of the work completed on the Tyne this year was for foreign account. On the Wear, the tonnage launched for foreign owners amounted to 52,000, or more than one-fourth of the whole output for the year, and adding to this 17,000 tons built for owners in other countries at Blyth, Hartlepool, and the two seats of shipbuilding on the Tees, we have a total of over 69,000 tons, which with foreign the tonnage launched on the Tyne brings this part of the account up to the large figure of 152,000 tons of shipping, built for foreigners in the area comprising the Tyne, Wear, and Tees, in 1890. This to our mind is a most interesting feature in the year's transactions, as it offers conclusive proof that so far as shipbuilding is concerned, the world is still largely dependent on the resources of this country, a state of matters which is not likely to be altered in this generation, unless a change is brought about by the unwise action of certain trade unions in imposing unnecessary restrictions, and otherwise hampering the employers in their efforts to carry on work in a manner consistent with sound business principles. At the moment the outlook is not particularly cheerful. There is a dearth of enquiries which augurs ill for future prospects, as many vessels that are to be launched in the early months of the year are not likely to be replaced on the stocks. Indeed, it is becoming apparent that labour is already too abundant, and it is no uncommon thing now to see groups of men standing about in the vicinity of the shipyards awaiting a chance of employment. There is, however, one section of men—the shipwrights—to which these remarks do not apply, and amidst an otherwise somewhat discouraging state of matters, it is pleasant to be able to state that so far as this class is concerned the demand greatly exceeds the supply. It is scarcely necessary to say that steel is still the material almost exclusively employed in ship construction, the use of iron being only resorted to for the building of trawlers and other vessels of a small class. On the Tyne 16 such vessels were built, having an aggregate tonnage of less than 3,000 tons. On the Wear one iron steamer of 699 tons was launched, and one sailing ship of 1,422 tons, but elsewhere on the North-East Coast no iron is recorded as having been used, and it would consequently appear that the proportion of iron as to steel entering into ship construction in 1890 is somewhat less than one per cent. That wood is not yet wholly abandoned may be inferred from the fact that on the Tyne and at Blyth four small vessels were built of this material, having an aggregate tonnage of 318 tons.

Among the vessels launched during the year at the various centres there are some to which special reference should be made. In this connection it may be mentioned that for several years past a few of the leading Tyneside firms have been steadily aiming at securing a good proportion of high-class work, and it is satisfactory to be able to state in the pursuit of this object they have achieved a large measure of success. The passenger steamers, *Grand Duke Alexis* and *Grand Duke Constantine*, launched during the year by Messrs. Hawthorn, Leslie & Co., are quite unique specimens of modern shipbuilding work, and whether for beauty of design, stability of construction, or elaborateness of interior ornamentation, it is safe to say that it would be no easy task to find their equals. The *Gulf of Ancud* and the *Gulf of Florida* are also two splendid vessels, and indeed there is not a vessel that was launched by this firm during the year that will not fully maintain their reputation as producers of high-class work. Messrs. Swan & Hunter turned out some beautifully finished passenger boats this year, among which may be specially mentioned the *Adriana* and the *Citta de Venezia*. Messrs. Richardson & Co., Messrs. R. Stephenson & Co., and the Tyne Shipbuilding Co. must also be congratulated upon the success achieved by them in turning out vessels of a superior type, among which may be mentioned the *Ragnvald Jarl* (Messrs. Richardson), the *Francisco* (Messrs. Stephenson), and the *Time* (Messrs. The Tyne Shipbuilding Co.). Among the Wear built vessels that deserve special mention are the *Pak-Ling* and the *Keemun*, two splendid steamers for the tea trade, which being designed on fine lines and supplied with exceptionally powerful engines, will doubtless acquit themselves creditably when put to the test. The *Fazilka* and the *Fultala*, built by Messrs. Doxford & Sons for the British India Steamship Co., are strongly built and elaborately finished, and the *Aquitaine*, built by the Sunderland Shipbuilding Co. to the order of a French firm, may fitly come under the same terms of description. Mr. James Laing and Messrs. R. Thompson & Sons also put some beautifully designed and handsomely finished vessels into the water this year, and on the whole it may be said with truth that the leading builders of the Wear have again demonstrated their right to occupy a foremost place as producers of passenger and cargo steamers.

The Palmer's Shipbuilding & Iron Co. do not occupy so high a position in the returns of tonnage launched this year as last, when they headed the list of the world's output with the magnificent total of 64,669 tons. They still however keep the honourable place of second, with the respectable figure of 45,312 tons—a figure, by the way, which would have been largely exceeded but for the fact that the company have been engaged in Government work. At the time of writing all their berths are occupied, and as the frame-bending department is still kept briskly going, there is little reason to doubt that in the coming year they will get through an exceptionally large amount of work. The Tyne Shipbuilding Co. have increased their output this year, as compared with last year, by 2,469 tons, their total for the current twelve months being 18,016 tons. This, it may be remarked, is a very creditable twelvemonths' output for a yard with only four building berths, and with one exception it is larger than the output of any leading Clyde yard, so far as can be gathered from the returns already published. Messrs. C. S. Swan & Hunter have had a successful year, having turned out 26,454 tons of shipping, which was mostly of a superior class. They have now four vessels in progress on the stocks, besides two or three others that are as yet in the initiatory stages. Messrs. John Readhead & Sons have, like the Tyne Shipbuilding Co., turned off two vessels this year from each of their berths (besides a small tugboat of 289 tons), the total number being 10, with an aggregate tonnage of 23,599 tons. Messrs. Hawthorn, Leslie & Co. are not conspicuously high in the record of tonnage launched so far as quantity is concerned, but in the matter of quality it can be said without exaggeration that they come very prominently forward. Messrs. Wood & Skinner's output for the year is chiefly remarkable for the large proportion of foreign work comprised in it, and the same may be said in regard to the output of Messrs. Wigham, Richardson & Co., and Sir W. G. Armstrong, Mitchell & Co. The shipbuilding firms who confine their operations to the building of trawlers and ferry steamers have done well during the past twelve months, and as such vessels are still in demand, the outlook in their case is better than can be said to exist in connection with the trade generally. Repairing establishments on the Tyne continue to be fairly well employed, and since the opening of the new graving dock, the Blyth Shipbuilding Co. have been particularly successful in securing this description of work. The company have now several repair contracts in hand, besides some four or five new vessels on the stocks.

Engineering.—The marine engineering shops are very little less active at the close of the year than they were at the beginning, though the restrictive measures imposed by the Engineers' Society with regard to the working of overtime and piecework, is somewhat limiting the output. Messrs. Hawthorn, Leslie & Co.'s establishment at St. Peter's is among the busiest on the river, and the Forth Banks Works of the same firm are also kept very fully employed. The Palmer's Company have quite an exceptional amount of work in their engineering department, and the steel works are kept going to their very utmost capacity. The new Ordnance Works which were commenced early in the year, are now well advanced towards completion, and will probably be ready for a start in productive operations about midsummer. Messrs. R. Stephenson & Co. are well occupied with both marine and locomotive work, and Messrs. Black, Hawthorn & Co. have a large number of contracts in the same special lines. Messrs. John Abbot & Co., have had a busy year and are still in a position to keep nearly the whole of their various departments briskly going. The activity at Messrs. John Spencer & Sons' works at Newburn and Newcastle is undiminished, and the great extensions that are being made in connection with the Newburn establishment are expected to be completed early in the year. Messrs. J. H. Holmes & Co., whose electric lighting works were largely extended at the beginning of the year, are still able to keep the whole of their machinery in full operation, the greater proportion of the work in hand consisting of steamship installations. Messrs. Noble & Buckle consulting engineers, have arranged to fit the

"Yaryan" evaporator, for which they are the principal agents, in a large steamer building for foreign owners by Sir W. Gray & Co., of Hartlepool, and there is reason to believe that they will have orders to fit it in a good many other new vessels that are now in course of construction. Mr. W. F. Snowdon, 32 Side, Newcastle, has been appointed sole agent in this district for the "Dodge Patent Wood Split Pulleys," which Messrs. Isaac Braithwaite & Son, of Kendal, are now introducing. It is claimed for these pulleys that they possess many important advantages over the different kinds of pulleys now in use, exceptional lightness, increased driving power, and easy adaptability to any size of shaft, being among the distinctive features alleged to belong to them. Messrs. George Angus & Co., who during the past couple of years have largely extended their premises, are receiving numerous inquiries for their specialities, the "Amianthus Cloth Packing" for triple-expansion engines being among those which are most in request. Messrs. Carrick & Wardale, of the Redburgh Engine Works, have been kept very busy throughout the year in all their departments, and besides chemical manufacturing plant for works in various parts of the country, they have now in hand a large number of their well-known patent pumps for use in steamships.

THE WEAR.

Shipbuilding.—A few of the Wearside shipbuilding yards are now beginning to look somewhat bare, some vessels having been recently launched that were not replaced by keels. There is no doubt, too, that employment is somewhat scarce, and numbers of men are either only irregularly employed or not employed at all. The busiest yards are Messrs. J. L. Thompson & Sons, Messrs. Short Bros., Messrs. Doxford's, Mr. James Laing's, and the Sunderland Shipbuilding Co.'s. The whole of the yards referred to have their berths fully occupied, and among the vessels in course of construction are several that are intended for the passenger service, or for fast sailing in special trades. Messrs. Osborne & Graham have a fair amount of work in hand, and Messrs. John Priestman & Co. are supplied with orders sufficient to keep the yard going steadily during at least the first quarter of the year. Messrs. R. Thompson & Sons and Messrs. Pickersgill, are both busier than they were at midsummer, and the former firm have a good amount of repair work to deal with in addition to their contracts for new vessels. The firm built but one ship at the Bridge Dock in 1890—a fishing vessel named the *Lincoln*, which is understood to have given special satisfaction to her owners—but they completed at that section of their works a great many repair contracts to the engines and hulls of vessels. Messrs. Bertram & Haswell and Messrs. John Blumer & Co. are both having a fair show of work on the stocks, but at the yards of Messrs. S. P. Austin & Co. and the Strand Shipbuilding Co. there is but a limited amount of new work in progress, repair work forming in each case the staple of the business dealt with. The builders of ships' boats continue to do a satisfactory business, and Messrs. M. Robson & Son, who hold the leading position on the Wear in this line, are just now having a large number of orders in hand. The firm are carrying out extensive alteration to their premises, which will doubtless have the effect of enlarging their productive resources. The large sawmills belonging to the firm have been kept steadily going all the year, and the prospect for the next twelve months appears to be very favourable.

Engineering.—The marine engine works are still showing every appearance of activity, and at every establishment vessels are now receiving their machinery. The output of the different works for the year has not yet been ascertained, but one firm is said to have turned out no less than 29 sets of engines, and if the others have done anything approaching this, the total will probably be equal to that of any former year. In the smaller engine works business is generally satisfactory, although inquiries for steam winches and other deck accessories are necessarily falling off with the decline in shipbuilding orders. Mr. A. A. Rickaby's establishment continues busy, the work in hand mainly consisting of piston rod packing, pumps, steam winches, and machine tool holders. At the Pier Engine Works a considerable amount of repair work has been done during the past few months, and the prospect of increased business for the coming year is good. Mr. W. Mills is doing a large trade in the manufacture of his patent boat gear, and the works at Bridge Crescent are kept exceedingly busy. Since the coming in force c[illegible] Life Saving Appliances Act (in connection with merchant shipping) shipowners appear to be giving more attention to the subject of boat lowering and disengaging gear, and this circumstance is, no doubt, contributing largely to the activity just spoken of. The Castletown steel works, and the Monkwearmouth iron works, are still fully employed, and foundries, copper works and forges are on the whole doing well. Chain and anchor works keep working pretty regularly, though symptoms of coming slackness are beginning to appear. Rope works are generally doing a fairly active trade, the demand for colliery requirements being still good. The strike of miners at Silkworth, which commenced a month ago, is stil unsettled.

The Hartlepools.—Messrs. W. Gray & Co. have the honour this year of holding first place in the shipbuilding returns of the United Kingdom, and it is without doubt a remarkable testimony to the industrial enterprise of the age that one firm can turn out in twelve months so large an amount of tonnage as that placed to the credit of this firm, namely, 64,253 tons. The achievement appears all the greater when it is considered that 27 vessels were launched to make up this high figure, and as the firm have no more than nine building berths, this means that three vessels, some of which were of very large tonnage, were put off from each berth during the year. This is a performance in the way of rapid production which we venture to say has never been equalled by any other shipbuilding firm, and which, if it should be equalled in the future, is scarcely likely to be surpassed. Messrs. Withy & Co. hold a good position in the returns, their output of tonnage for the year amounting to over 26,000 tons, which is 5,000 tons better than the output of the preceding year. At the Central Engine Works business keeps up to the standard of briskness mentioned in previous reports, and during the past four weeks the usual number of steamers that have been engined at the works have gone to sea. Amongst these may be specially mentioned the s.s. *Tekoa*, which is a sister ship of the *Rangitira*, and is owned by the New Zealand Shipping Co., London. This is a very large vessel, carrying about 6,300 tons deadweight, and she is fitted with refrigerating machinery for the meat trade between New Zealand and London. On her trial trip a speed of 12½ knots was shown, which of course was eminently satisfactory. The s.s. *Frieda*, owned by Otto Trechman, Esq., of West Hartlepool, made an excellent trial trip, and proceeded direct to Cardiff to load. The s.s. *Oaklands*, being the fourth vessel fitted with triple engines at the Central Works for Messrs Hardy, Wilson & Co., of West Hartlepool, had a very successful trial trip off Hartlepool, and the s.s. *Zanzibar*, a large vessel built by Messrs. E. Withey & Co., for Mr. Frederick Woods, of London, and engined at the Central Works, proceeded to Antwerp to load for China, after a trial in which she made 11½ knots. The s.s. *Macduff*, a vessel carrying about 4,500 tons, and built for Messrs. Warrack & Co., of Leith, also proceeded on her trial trip on the 26th December. The engines have also been put in the s.s. *Guernsey*, a vessel of 4,300 tons deadweight, built for Messrs. A. Hansen & Co., of Copenhagen, and the s.s. *Heighington*, a vessel of the same size and carrying capacity as the *Guernsey*, built for the Hudson Shipping Co., of West Hartlepool. The machinery has also been fitted in the s.s. *Taurus*, belonging to Messrs. Withelmsen, of Bergen, and in the s.s. *Clyde*, a vessel of about 4,500 tons, following the *Taurus* at the sheerlegs. All the departments remain busy, and the list showing the years' work for this establishment, which is given below, will sufficiently indicate the activity that has existed throughout the year, the output reaching the high figure of 37,100 I.H.P. List of vessels engined in 1890, with the I.H.P. in each case:—*Umbilo*, 1,250, *Greatham* 1,200, *Lizzie Cory* 700, *Armenia* 1,250, *Pocklington* 800, *Rangitira* 2,000, *Langoe* 1,200, *Halifax City* 1,200, *Malvern* 1,300, *Fulham* 1,000, *Kingsland* 1,000, *Manchester* 1,200, *Taurus* 1,200, *Tetartos* 1,300, *Sestus* 1,000, *Tekoa* 2,000, *Norma* 1,200, *Alloa* 900, *Ipsden* 900, *Coatham* 900, *Umhlali* 1,300, *Herman Wedel Jarsberg* 1,500, *Bushmills* 1,300, *Frieda* 1,200, *Oaklands* 1,000, *Macduff* 1,700, *Zanzibar* 1,500, *Guernsey* 1,300, *Heighington* 1,300, *Clyde* 1,500. At Messrs. Richardson & Sons' Works, the activity during 1890 has been well maintained, and the output has exceeded the highest record of former years. Although there has been no engineering work of the very largest class done in the port this year, the general tendency has been towards engines considerably above the previous average. Messrs. Richardson & Sons have this year turned out 33 sets of engines and boilers, with a total I.H.P of 45,400, entirely consisting of triple-expansion engines and boilers, designed for the highest pressures now used. In addition to this they have had a very large share of general repair work, and in one department alone—that devoted to the manufacture of shafting—the output has been 132 crank and propeller shafts during the twelve months. Another speciality of the firm which is finding increased favour with shipowners and engineers is Morison's patent evaporator and feed heater. Since beginning the manufacture of these accessories some fifteen months ago, nearly 200 have been sent off. The improvement in the condition of the boilers to which these have been applied has been so great, and the saving in boiler cleaning expenses so substantial, that in every case the order has been followed by repeats, and both superintendents and engineers are unanimous in their praise. The output from the forge during the twelve months now closing has been 2,250 tons, or nearly 200 tons per month, most of the forgings being of ingot steel of the highest quality. In this connection it may be stated that over 700 built crank shafts have now been turned out at these works. During the last few years Messrs. Richardson & Sons have been gradually altering their establishment, which having been founded a good many years ago, was not exactly in keeping with the requirements of modern practice in engineering. The year that has past has seen the last of the old building demolished, and its place occupied by a spacious and well-lighted machine shop. This alteration has been completed without seriously interfering with the working of the various machines. The improvement has been of the most marked kind, the low-roofed and gloomy building having given place to a modern shop, conducive to better work, as well as to improved health among the workmen. The extensions consist of three lofty bays, having a total length of 312 ft., and the alteration has considerably increased the size of the principal machine bay, the total length of which is 364 ft. This bay is served by three travelling cranes of the most improved type, and the whole of the machine shops have now been laid with light railways, so that every facility has been provided for the speedy and convenient handling and transport of material. Among the achievements of the year may be ranked the manufacture of new machinery for the s.s. *Requiersz*, of De Rininkyike, Paketvaars Maatschappy. This steamer was built in Holland for the mail service in Batavia. A set of engines was also built in that country for the vessel, but these had been destroyed by fire, and as she had been chartered by the Government to be on her station within a limited time, it was a matter of importance to provide new machinery as speedily as possible. Messrs. T. Richardson & Sons undertook the work and guaranteed to construct the machinery, fit it on board, and finish all the shipwork within twelve weeks from the date of order. They, however, completed the work in eleven weeks, and the vessel sailed from Amsterdam on the date originally fixed.

Middlesbro'.—Messrs. Sir Raylton Dixon & Co., of the Cleveland Dockyards Nos. 1 and 2, have launched in 1890 about 3,000 tons more tonnage than in the previous year, the majority of the vessels turned out being of large size. Among the most noteworthy may be mentioned the s.s. *Ovingdean Grange*, built to the order of Messrs. Houlder Bros., and specially designed and fitted for the frozen meat trade. They have also executed a large contract for eight vessels, for Messrs. A. Holland & Co., and are now preparing to launch a splendid steamer for the China Mutual Steamship Co. On the whole their record for the year is one of which they may well be proud, and points to the satisfactory management of the establishment. Messrs. W. Harkess & Son, who, it may be remembered, met with a serious disaster last year—a fire having completely destroyed the whole of their joiners' shop and machinery sheds—have been busier during the past year than in any previous year since they commenced business. On the site of the old joiners' shop stands a splendid new building, comprising moulding loft, polishing room, and joiners' shop. The firm have added greatly to their plant during the year, and have extended their operations so much that they have been enabled to put off their stocks six vessels and three steel barges, a performance which speaks well for the management, considering that the yard has only two berths. Among the vessels launched may be noted, particularly, one for the Union Steamship Co. of New Zealand, a firm which, until recently, have confined their orders entirely to the Clyde. The s.s. *Elisa Cerana* was a unique specimen of naval architecture, being 200 ft. long, and only 8 ft. 6 in. deep, while she attained a speed of 15 miles an hour, with 300 tons deadweight, on a draft of 7 ft. This vessel performed the voyage from the Forth to Buenos Ayres in 29 days. There were several other vessels launched by the firm which deserve special notice, and with reference to which we hope to have something to say next month.

Stockton.—The Stockton shipbuilders have also increased their output this year as compared with last, and are now generally pretty busy. Since November 19th Messrs. Blair & Co. have had trial trips of the following steamers engined at their works:—The s.s. *Uplands*, built by Messrs. Ropner & Son for Messrs. Hardy, Wilson & Co. of West Hartlepool, having engines of 160 H.P. nominal, with cylinders 21 in., 35 in., and 57 in., by 39 in. stroke. The s.s. *Chelydra*, built by Messrs. J. L. Thompson & Sons, Sunderland, for C. Hutchinson, Esq., of the same town, having engines of 210 H.P. nominal, with cylinders 23 in., 38 in., and 62½ in. by 42 in. stroke. Both these sets of engines are constructed to work at 160 lbs. pressure of steam, and on the trial trips gave great satisfaction.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—A very brisk business has been done in the shipbuilding industry of the district during the past month, and a large amount of the work in hand has been got very well forward during the time. No new orders have been booked, but it was scarcely to be expected considering the great responsibility already undertaken by builders. During the month the *Naiad* has been launched, the third of the second-class cruisers which are being built at Barrow for the Admiralty, and the *Latona*, the first of the cruisers launched, left Barrow on the 19th inst. on her trial trip, with every indication of a most successful voyage. The Naval Construction and Armaments Co. has also launched during the month the *Empress of Japan*, the second of the Canadian Pacific Railway Co.'s steamers for service between Vancouver, Japan, and China. The *Empress of India*, the first of these boats, is now practically ready for sea, and at the end of the present month or early in the New Year she will proceed on her trial trip in the direction of London, from which port she is to sail on January 15th, on a tour round the world. It is interesting to note that her passenger list is already full, and that the passenger list for the *Empress of Japan*, which will follow on a voyage round the world in a month or six weeks after the *Empress of India*, is also full. The *Empress of China*, the third of these steamers, is to be launched in the month of January.

The other work which shipbuilders and engineers have in hand at Barrow will keep them busily employed during the earlier months of the year during which the arrangements will, it is confidently expected, be completed for commencing the work not only of building four fast Atlantic steamers to run between London, a port in France, Plymouth, and Halifax in Canada. These ships, which are to be the greyhounds of the Atlantic, and to have a mean speed of 20 knots, will be the property of a limited company, which will soon be floated. Lord Hartington, chairman of the Naval Construction and Armaments Co. on the occasion of the launch of the *Empress of Japan* referred to this new company and said the enterprise which had been set on foot by Mr. Bryce Douglas, as a result of his recent visit to Canada, would doubtless be delayed in its inception owing to the present state of business of the country, but his lordship was assured that sooner or later the scheme would be developed, and that the enterprise would be largely helped by the Naval Construction Armaments Co., with whom a pronounced agreement has already been made for the building not only of the four steamers named for the Canadian Atlantic service but three other steamers for the service between Vancouver, Japan and China. The order for these seven ships at Barrow holds out a good prospect for at least two years in the shipbuilding and marine engineering industry of this town. The record of shipbuilding and engineering at Barrow during the past year shows that the Naval Construction and Armaments Co., whose yard is the only one at present working, launched six steel steamers during the current year, with a total tonnage of 24,665, and built eight sets of machinery, aggregating 52,600 I.H.P. It is expected that this record of tonnage will be considerably increased next year. The Naval Construction and Armaments Co., Limited, have declared an *interim* dividend at the rate of 8 per cent. per annum on the half-year's working ending

December 31st. This compares with 6 per cent. *interim* dividend declared last December, as the financial prospects of the company have greatly improved. There is no immediate prospect of the shipbuilding yard of Messrs. Caird, Purdie & Co. being restarted at Barrow. An opportunity to dispose of it was lost a short time ago, and now there is the rumour of the proposal to establish at this place works for the manufacture, by means of rolling, of steel paraffin casks, on a patent held by Mr. David Caird, who is much interested in the bulk petroleum trade. The opinion is well entertained at Barrow that there is a good opening for a second shipbuilding yard at Barrow, of course on a much smaller scale than that of the Naval Construction and Armaments Co. Many orders which the latter cannot undertake could be handed over, and then there is of course the open market, and a large repairing trade, for which the port of Barrow is admirably situated, and which would be a source of profit to a small company. It is certain that sooner or later there will be another shipbuilding yard at Barrow, in fact the idea is already in the minds of those who are developing a large business in marine engineering.

Workington.—At Workington during the year two vessels of 2,884 tons were launched by Messrs. R. Williamson & Son, and they have fair prospects for the New Year.

Whitehaven.—No new ships have been launched during the year at Whitehaven, as the yard has been closed, and the overtures with Messrs. Gilchrist & Co., engineers, of Liverpool, have not apparently come to anything.

Maryport.—Messrs. Ritson & Co. Maryport, are building a new sailing ship for their own use.

THE MERSEY.

THERE is no specially new feature to notice with regard to the shipbuilding and marine engineering industries of this district, and the condition of trade at the shipbuilding yards on both sides of the Mersey remains much the same as reported last month. Messrs. Laird Bros. of Birkenhead continue very busy and their principal contract, the building of the first-class line-of-battle-ship the *Royal Oak* for the British Government, is making very satisfactory progress, whilst further work is now being done on the *City of Paris* in getting her ready to be sent round to the Clyde to receive her new engines. The refitting of the London and North Western Railway Co.'s paddle steamer *Violet*, with triple-expansion engines in the place of her low-pressure oscillating engines has now been completed. As this is probably the biggest thing that has yet been done in supplying triple-expansion engines to a paddle steamer, the results obtained will be of considerable interest, and in a future issue we intend giving particulars of the official trials which have just been made. Messrs. Laird Bros. have also during the past month launched from their works a twin-screw armourclad ram for coast and river service, the first of two which they are constructing for the Government of the Argentine Republic. The vessel was named the *9 de Julio* by Mrs. John Laird in the presence of Colonel F.Spun, Cobena, Colonel Raminez, and a number of other officers of the Argentine Navy. The 9 *de Julio* is a vessel of about 2,500 tons displacement and 3,000 I.H.P., and will have good speed. She will be protected by ample steel armour and will carry a heavy armament of the most modern breech-loading guns mounted "en barbette." Messrs. Thomas Royden & Sons still report no new work coming forward, and the only matter to notice is the completion for official trial during the past week of the *Obidense*, a new steamer of 2,379 gross register tonnage, and 1,800 I.H.P. which they have recently launched, and which has been engined by Messrs. Fawcett, Preston & Co., of Liverpool. Messrs. W. H. Potter & Sons have practically ceased working altogether for the present owing to their inability to come to any satisfactory arrangement with their men. It will be remembered that some time back in the absence of new orders coming forward, the firm with a view of keeping their works going commenced the building of a vessel on their own account, but further operations have been now stopped owing to the unreasonable demands put forward by the platers. It may be mentioned that the wages of the platers have advanced fully 40 per cent. as compared with what they were receiving within a very recent period, and the men apparently are not satisfied even with this rate of pay. It is, however, not only in the matter of wages, but also with regard to work that difficulties are experienced which prevent shipbuilders taking new orders under present conditions. During slack times it was no uncommon thing for an ordinary gang of men to put on 100 to 120 plates per week, but now the average work by a similar gang of men does not exceed 50 plates per week, and this restricting of the amount of work which the men are only willing to do caused considerable difficulty and delay in the completion of the last vessel which Messrs. Potter & Sons had on their stocks.

With regard to the shipbuilding industry on the Mersey during the past year, the returns of the principal firms show that business has been fairly active, although the total tonnage turned out in 1890 does not equal that of the previous year. The total tonnage turned out during the past year is 27,763, as compared with 35,773 tons in 1889, 22,538 in 1888, 10,664 in 1887, and 20,966 in 1886. Messrs. Laird Bros., of Birkenhead, have been exceptionally well supplied with work all through the year, and have built the following steamers, all of steel:—The *Ottoman*, 4,843 tons gross register, and 3,000 I.H.P.; the yacht *Norseman*, 231 tons, and 350 H.P.; the Chilian gunboats *Almirante Lynch* and *Almirante Condell*, each of 613 tons, and 4,500 H.P.; the gunboats *Esperer* and *Rosales*, each of 433 tons, and 3,250 H.P.; and the man-of-war, *9 de Julio*, 2,000 tons, and 3,000 H.P., the last three being for the Argentine Confederation. In addition to the above, Messrs. Laird Bros., have also constructed the engines of Her Majesty's ships *Speedwell* and *Shipjack*, each of 4,000 H.P., and those for the paddle steamer *Violet*, also of 4,000 H.P. Messrs. Thomas Royden & Sons have built the following vessels, all for Liverpool owners:—The steel steamer *Indrapura*, 3,859 tons gross, and 1,800 I.H.P.; *Saladin*, 1,998 tons, and 1,000 H.P.; and *Obidense*, 2,379 tons, and 2,400 H.P.; and also the steel sailing ship *Crompton*, 2,809 tons. Messrs. W. H. Potter & Sons have launched the iron steamer *Gorgon*, 986 tons, and 660 H.P.; and the sailing ships, *Altair*, 2,452 tons, and *Dumfermline*, 2,902 tons. Messrs. R. & J. Evans & Co. have built the iron ship *Atacama*, 1,142 tons, and have also been busy in repair work all through the year. Messrs. Harland & Co. have turned out the wooden sailing barge *Aileen*, 70 tons, and in addition to repair work, they have now in hand a wooden steam barge, to carry about 300 tons. Messrs. Clover, Clayton & Co., who lay themselves out specially for repairs, have been moderately busy during the year. Their principal job has been the restoration of the steamer *Ligurian*. The fore end of this vessel, after having been abandoned by the underwriters was purchased by Messrs. Clover & Clayton, ballasted, bulkheaded, and successfully floated into their graving dock. The after-part having been previously floated by the Salvage Association, the two ends were put together, and the vessel restored to her original class in Lloyd's. The same firm have also in hand several Norwegian and German vessels to repair and reclass. Mr. William Newall, of Garston Dock, has been fairly busy in repairs, and the same may be said generally of all the leading firms.

The leading marine engineering firms and marine boilermakers have been generally well supplied with work throughout the year, but with the close the outlook is not at all of an encouraging character. Marine boilermakers are still well off for work and do not report any very material slackening off in the immediate future. Marine engineers are, however, completing the orders they have received some time back, and are receiving very little new work.

The iron trade during the year has passed through an extraordinary revolution in business. The year opened with a feverish anxiety to buy at almost any price, whilst now in December there is an equal pressing anxiety to sell, and in many instances a perfect scramble after business almost at any figure that buyers are prepared to give. In pig-iron there has been a decline in prices according to brand of 25s. to 30s per ton, and in finished iron of from £2 5s. to £2 10s. per ton, as compared with the rates which were quoted in January. In the pig-iron trade the year opened with a strong upward tendency, and inquiries coming forward far in excess of what either makers or merchants were disposed to entertain. Makers were already so heavily oversold that they had little or nothing to offer, whilst merchants, in view of anticipated further upward movements in prices, and the difficulty of obtaining supplies, were excessively cautious about committing themselves to further engagements. For local and district brands quotations averaged about 72s. 6d. to 73s., for Lancashire; 74s. to

75s.; and 75s. 6d. for Lincolnshire; and 78s. to 78s. 6d. for the best foundry brands of Derbyshire, less 2½ delivered, equal to Manchester. During the early part of January there was a continued strong upward tendency in prices, Lancashire makers ceasing to quote altogether, whilst, for Lincolnshire, quotations reached 75s. to 77s. 6d., and for Derbyshire 81s. 6d., less 2½ delivered. Before, however, the close of the month, the altogether unexpected collapse in the warrant markets at Glasgow and Middlesbro' brought about a sudden cessation of further buying. Makers being still well sold were for the time being enabled to hold on to their prices, but as merchants began to "bear" the market freely, gradually makers' prices were forced down, and during the first three months there was a giving way of quite 10s. to 15s. per ton according to brand, business being done in Lincolnshire at about 60s. per ton, with Derbyshire quoted about 68s. and Lancashire about 59s., less 2½ delivered. With one or two slight fluctuations, the market continued in a depressed condition all through the ensuing quarter, with consumers buying only from hand to mouth and prices tending steadily downwards, Lancashire makers quoting about 48s. to 49s., Lincolnshire from 47s. to 47s. 6d., and Derbyshire from 47s. 6d. to 50s., less 2½ delivered. During the first portion of the second half of the year there was some temporary improvement, but any actual increased weight of buying was brought about mainly by the anxiety of merchants and dealers with regard to the future, owing to the threatening aspect of labour difficulties. Merchants bought pretty largely for forward delivery, and this brought about an advance in prices of something like 1s. 6d. to 2s. per ton from the lowest figures which had been taken, Lancashire makers being firm at 50s. to 51s. 6d., Lincolnshire 48s. 6d. to 49s. 6d., and Derbyshire at from 49s. and 50s., up to 53s. less 2½ delivered. These advanced prices, however, very quickly checked further buying, and before the end of the third quarter business was again getting back into its previously quiet condition. With the close of September the commencement of the dispute with the blast-furnacemen in Scotland again gave a temporary stimulus to the market and strengthened prices for the time being, Lincolnshire getting up to 50s. and 52s., and the best foundry brands of Derbyshire up to 55s. 6d., less 2½ delivered. The improvement, however, was only shortlived, and, notwithstanding the continuance of the strike on the Clyde, prices steadily declined. The withdrawal, to some extent, of Scotch and Middlesbro' iron from the Manchester market helped to strengthen the position of local and district makers; but notwithstanding this they were unable to maintain their price, and business relapsed into an altogether lifeless condition. As the year further advanced the financial troubles in London added to the generally depressed condition of trade, and prices were still further forced downwards, until with the close of the year Lincolnshire iron is obtainable at about 45s. 6d. to 46s. for forge, and 47s. 6d. to 48s. for foundry and Derbyshire at from 45s. for the cheaper forge qualities to 50s. and 51s. for good foundry brands less 2½ delivered, equal to Manchester; local makers quotations are nominally on the basis of 48s. 6d. to 49s. 6d., less 2½, but are altogether out of the market.

Finished iron makers started the year well supplied with orders, and prices firm on the basis of £8 10s. to £8 12s. 6d. for bars delivered in the Manchester district. The activity in finished iron, however, was not long maintained, and with no new orders of any weight coming forward makers very soon exhibited an anxiety to secure work, with the result that buyers had to be tempted with considerable concessions in prices. During the first three months bars got down to £8 per ton, and by the close of the first half of the year makers were ready sellers at £6 10s. per ton delivered. There was a further giving way in prices during July, until £6 5s. became a very general figure, and then followed some increased weight of buying which brought quotations back to £6 10s. This improvement, however, was only temporary, and during the closing portion of the year finished iron makers have been only indifferently employed from hand to mouth, whilst prices have been forced down to a still lower point than ever, Lancashire bars being obtainable without difficulty at £6 2s. 6d., and North Staffordshire qualities at £6 5s. delivered in the Manchester district.

The steel trade has followed very much the same fluctuations that have taken place in iron, and in both raw and manufactured material there has been a very large giving way in prices during the year, hematites having dropped nearly 30s. per ton, whilst in steel plates the decline has been more than £3 per ton upon the top prices touched in January last. In hematites good foundry qualities at the commencement of the year were quoted at about 91s. to 92s., less 2½ delivered, equal to Manchester, and with only temporary improvement they have shown a steady downward tendency, until at the close they are not quoted at more than about 64s., less 2½, and this figure is considerably above what buyers are prepared to pay. Steel plates, which during the preceding year showed a steady upward movement in January, advanced to about £10 10s. and £10 15s. for ship plates, with steel boiler plates touching as high as £12 5s. per ton, but these prices were not long maintained. A steady downward movement commenced before the close of the first month, and before the end of the first half of the year steel boiler plates were offering at £7 17s. 6d. to £8 per ton, and ship plates at as low as £6 15s. per ton delivered ex-steamer Liverpool. These latter figures brought forward a fair amount of buying, and gradually there was a slight recovery in prices until steel boiler plates were quoted at £8 5s. to £8 10s., and ship plates at about £7 10s. per ton delivered ex-steamer Liverpool. A downward tendency has, however, set in with the close of the year, and in the absence of business coming forward there is scarcely anything to really test values, but steel boiler plates could be bought readily at £7 17s. 6d. to £8, and steel ship plates at about £7 per ton, although the leading makers are quoting nominally about 5s. to 7s. 6d. per ton above these figures.

In the general engineering branches of industry, which commenced the year fully supplied with work in all departments, activity, has been well maintained during the whole of the twelve months, and the returns of the trades union organisations have shown the smallest average of unemployed upon their books that has been recorded for a great many years past. Towards the close of the year there has been some slackening off here and there as regards the weight of new work coming forward, but excepting the shipbuilding industry, it can scarcely be said that the year closes unsatisfactorily as regards the leading engineering trades of this district.

In the coal trade although prices are, notwithstanding the advance of 10 per cent. in wages conceded to the men, lower at the close of the year than those which were ruling in January, there has been a fairly satisfactory business doing during the past twelve months, and prices have not shown any very extraordinary fluctuation. At the commencement of the year good ordinary descriptions of steam coal suitable for shipment were being quoted at about 10s. 6d. to 11s. per ton delivered at the ports on the Mersey. These prices were tolerably well maintained during the early portion of the year, but during the summer months, when the house coal trade became very slack, and necessarily a good deal of round coal was thrown upon the market, some portion of which had to find an outlet through the shipping trade, prices got down to about 9s. 6d. per ton. During the latter portion of the year there has been a fairly active trade doing until business became disorganised by the strike at the Garston Docks, the result of which was to throw a large quantity of shipping coal upon the market, and this had to be forced for sale at low figures. With the close of the year prices are still somewhat irregular, but good qualities of steam coal delivered at the ports on the Mersey average about 10s. to 10s. 6d. per ton.

In the metal market a fairly active business continues to be done, and manufacturers generally are well supplied with orders, but with the giving way in raw material there has been some easing down in prices, and brass and copper tubes have been reduced ½d. per lb., the quotations for delivery in the Manchester and Liverpool districts being now as under:—Seamless brass tubes 7¾d., surface condenser tubes 9d., brass wire 7½d., copper wire 9d., rolled brass 7¼d., sheet brass 8½d., to 8¾d., and yellow metal sheathing nails and spikes 8¾d. per lb.

In the timber trade the imports have again been moderate, and values have been fairly maintained, but the deliveries generally have been disappointing, and slacks of most articles continue heavy.

THE "UMBRIA" AND "ETRURIA."—It is stated the Cunard Co. directors propose taking the present compound engines out of their steamers *Umbria* and *Etruria*, and replacing them with triple-expansion engines to be constructed by Clyde engineers.

WELSH NOTES.

NO improvement is to be noted in the iron and steel trades. There is still a brisk demand for tinplate bars, but enquiries for rails and sleepers are very few. The pig-iron trade is unsettled, owing to the fluctuations in the warrant market. Welsh hematite No. 4 is quoted at 60s., and second quality at 50s., at works. The coal trade has been very active, and shipments have been considerably above the average of the year. All the principal colliery stems are full, and there is every prospect of a busy period. It is difficult to obtain steam coal for prompt shipment at any price. Patent fuel makers continue busy, and as orders are coming in regularly, prices are stronger. There is a fair demand for coke.

Bristol Docks.—The Bristol Docks Committee met on Monday at Avonmouth Dock, and considered on the spot some important proposals for its development. They decided to proceed with works which are estimated to cost over £12,000, but the recommendations of the sub-committee to spend £65,000 on a graving dock, and £34,000 on an extension of the present dock, were not approved. The engineer was, however, instructed to submit for consideration a smaller scheme of extension at an estimated cost of £4,000.

BELFAST TRADE NOTES.

THE engineering and shipbuilding trade here show no prospect of any diminution of the activity which has characterized it for such a considerable time past, although Messrs. Harland & Wolff have only one new steamer at their finishing berths, this being owing to the rivetters' dispute during the past year, which retarded the work on the vessels in hand, but during the ensuing few weeks they will have some large vessels launched.

As mentioned in our last report, besides the twin-screw cargo steamer for the White Star Line, they have also in process of construction two steamers to the order of Messrs. Leyland & Co., Liverpool, a passenger and cargo steamer for the McIver Line of the same port, a large passenger steamer for the Dominion Line, and two for Messrs. Bibby & Co., Liverpool.

The s.s. *Memphis*, built to the order of Messrs. Elder, Dempster & Co., British and African Steam Navigation Co., Liverpool, sailed for London on 27th November.

The s.s. *Ernesto*, built to the order of Messrs. G. H. Fletcher & Co. Liverpool, left for that port after a most successful trial trip in Belfast Lough on 11th December. They had only one launch during the month—a fine screw steamer, the s.s. *British Crown*, for the British Shipowners' Co., Liverpool, and which will be ready for sea early in January.

The s s. *Texas* arrived in Belfast on 20th December, for new boilers and the alteration of her engines to the triple-expansion type.

They are now erecting additional tools in the new additions just made to their engine works.

Messrs. Workman, Clark & Co., Belfast Shipyard had two launches during the month, the s.s. *Eveleen*, to the order of Mr. John Milligen, Belfast, and a new steam ferry for the Belfast Harbour Commissioners, the engines and boilers for which are being supplied by Messrs. Cochran & Co. Birkenhead. The s.s. *Celtic King* was towed to Glasgow to receive her engines and boilers.

Messrs. McIlwaine & Maccoll, Limited, still, we are pleased to say, continue very busy, and are rapidly pushing forward the new steamer for the new Belfast and Liverpool Line to the order of S. Lawther, one of which is expected to take her place on the new station in the month of February, 1891.

The fine steamer, the s.s. *Parkmore*, for Messrs. Johnston & Co., Liverpool, left here for that port on 3rd December.

Messrs. Victor Coates & Co., Limited, Prince's Dock Works, have now the s.s. *Helen Craig* ready for sea, she having received her engines and boiler at their hands.

Messrs. J. Pollock & Co. had the s.s. *Lady Arthur Hill* in hands for repairs.

The London and North-Western and Lancashire and Yorkshire Railway Co.'s, who own the fine line of passenger steamers trading between Belfast and Fleetwood, have ordered a twin-screw steamer over 300 ft. long, of large power and light draft, to suit the port of Fleetwood, and to be ready to take her place on that trade in the beginning of 1892. The order has been entrusted to Messrs. Laird, of Birkenhead, and is a new departure for the company, as all the boats on this trade have hitherto been paddle steamers.

Another addition to the cross-channel steamers plying to this port is announced in connection with Messrs. Burn's fine fleet, by their having ordered a large screw steamer for cargo principally.

Still another, the City of Dublin Steampacket Co., whose steamers among other ports ply to Belfast, have ordered a new steamer from Messrs. Caird & Co., Greenock.

Three fine new steam cranes have been erected on the Quays by the Belfast Harbour Commissioners.

A dispute with regard to the rate of pay of the engineers in the dredges has taken place, and the Amalgamated Society of Engineers have withdrawn the men, the dredges now being tied up; it is to be hoped that the matter in dispute may be settled amicably without any delay.

During the month the s.s. *City of Bristol*, of Messrs. Palgrave, Murphy & Co.'s line, after discharging her general cargo here, loaded a cargo of iron ore for Rotterdam, though upwards of 50,000 tons of this ore is exported yearly to English ports; this is, we believe, the first shipment to the Continent, and it is to be hoped that the result may be a regular trade in the ore from here.

LEITH NOTES.

THE shipbuilding yards at Leith had a good share in the revival of trade last year. As a result the output was the largest since 1883, and showed an increase of 4,054 tons on the previous twelve months. This year trade has not been quite so good, but the falling off is not very great. The same number of vessels were launched as last year, but a number were of less dimensions, and as a result the total tonnage is down by 4,751 tons. Altogether there have been completed 16 vessels of 13,025 tons, as compared with 17,776 tons last year. This total is also higher than in any year since 1883, when the output was 13,722. Messrs. Ramage & Ferguson launched four steel screw steamers, one steam yacht, and one sailing barque. The total gross was 8,584 tons, with an I.H.P. of 7,071. Messrs. S. & H. Morton & Co. completed four steel screw steamers of 3,641 tons—all of which, with the exception of one, were for foreign owners—as compared with five steel steamers last year. Messrs. Hawthorns & Co. finished six vessels of about 800 tons. The repairing and general work for the year was fully up to the average. For the coming year the prospects are very favourable. Messrs. Ramage & Ferguson have on hand three steam yachts, two sailing vessels, and one steamer, while Messrs. Hawthorns & Co. have five small vessels on hand.

Trade at the port of Leith during the year which has just drawn to a close has been, on the whole, well maintained. One or two trade disputes interrupted the work to some extent in the docks, but these troubles seem to have been got over, and for the last few months everything has gone smoothly.

The trade with vessels of large tonnage being on the increase, the Dock Commission are endeavouring to keep pace with the times, and are preparing a Bill for Parliament to give them power to construct a deep dock for this class of vessel. There arrived at the port during the eleven months ending on 30th November, 4,440 vessels of 1,242,667 tons, as compared with 4,216 vessels of 1,112,995 tons last year, being an increase of 224 vessels of 129,672 tons.

The Grangemouth Dockyard Co., of Grangemouth, have launched during the year about 18,000 tons as compared with 14,047 tons last year, showing an increase of about 4,000 tons, and the work this firm have on hand guarantees a good half year at any rate.

On December 1st, Messrs. S. & H. Morton & Co. suspended payment, and at a meeting of creditors the estate showed liabilities to be £28,000 and assets £10,000, leaving a deficiency of £18,000. It is expected a settlement will soon take place, when the yard will resume work as formerly.

At the end of last month Messrs. Gourlay Bros., Dundee, launched the largest ship yet built there, the *America*, a steamship 450 ft. long over all, 46 ft. breadth moulded, and depth 35 ft. 9 in. moulded, with engines 3,000 I.H.P., built to the order of the National Steamship Co., of Liverpool.

INCREASED BOILER PRESSURE AND INCREASED PISTON SPEED FOR MARINE ENGINES.*

By William Russell Cummins.

THE object of this paper is to raise a few questions as to the advisability of increasing (1) the working pressure, and (2) the piston speed of marine engines; and to consider what type of engine and boiler would best suit these new conditions. The superiority of the three-crank triple-expansion engine over the old two-crank compound is generally attributed to three causes:—First, to increased working pressure giving a greater total temperature range, and allowing of a greater ratio of expansion; secondly, to decrease of temperature range in each cylinder, thus causing less loss from cylinder condensation; and thirdly, increased piston speed.

To compare the economy of steam of 165 lbs. absolute pressure with steam of 115 lbs. pressure, let it be assumed that we have 1 lb. of a dry saturated steam at 115 lbs. absolute pressure. A certain quantity of coal has been expended to produce this lb. of steam; and the first question which arises is—How much coal will be expended to produce 1 lb. of steam at 165 lbs. absolute pressure? The efficiency of the heating surface should be rather less in the case of the higher pressure, as the temperature of the water will be higher. Assuming, however, that the efficiency is not appreciably decreased for the extra rise of temperature (72 degs. Fah.), then for the same amount of coal expended we have—

$$1 \times \frac{\text{Total heat of 1 lb. steam at 115 lbs. pressure}}{\text{Total heat of 1 lb. steam at 165 lb. pressure}} = \cdot 99305 \text{ lbs.}$$

steam at 165 lbs. absolute pressure, to compare with 1 lb. of steam at 115 lbs. absolute pressure.

Next, assume that the steam of 115 lbs. pressure is expanded adiabatically to 8 lbs. absolute, and that the steam of 165 lbs. pressure is expanded to 6 lbs. absolute, the back pressure in both cases being 4 lbs. (using a formula given by Rankine for the amount of liquefaction due to expansive working), we have for the proportion of liquefied water at the end of expansion the expression—

$$1 - \frac{T_2}{H_2}\left(J \text{ hyp. log. } \frac{T_1}{T} + \frac{H^1}{T^1} \right),$$

where T_1 — absolute initial temperature;
T_2 = absolute temperature at end of expansion;
H_1 = latent heat per lb. of initial steam;
H_2 = latent heat per lb. of steam at end of expansion.

Thus, for steam of 115 lbs. absolute pressure, and terminal pressure 8 lbs. absolute—

T_1 = 799·01 degs. Fah.,
T^2 = 644·11 degs. Fah.,
H_1 = 675864 ft. lbs.,
H_2 = 761381 ft. lbs.,

and the portion of steam liquefied = 14·34 per cent.; so that, at the beginning of expansion, there is 1 lb. of steam at 115 lbs. absolute pressure and at the end of the expansion ·8563 lbs. steam at 8 lbs. absolute pressure and ·14237 lbs. water. For convenience, let it be assumed that this proportion does not vary during the exhaust period. Then, heat received = total heat of 1 lb. steam at 115 lbs. absolute pressure = 1216·974 thermal units. Heat rejected = total heat of ·8563 lbs. steam at 4 lbs. absolute pressure = 993·843 thermal units + heat of ·1437 lbs. water at same temperature = 22·043 thermal units. Total heat rejected = 993·843 + 22·043 = 1015·886 thermal units.

1216·2741 — 1015·886 = 201·088 thermal units utilised.

For steam of 165 lbs. absolute pressure, and terminal pressure 6 lbs. absolute—

T_1 = 826·94 degs. Fah.,
T^2 = 631·32 degs. Fah.,
H^1 = 660110 ft. lbs.,
H^2 = 768333 ft. lbs.,

and the proportion of steam liquefied at the end of expansion = 17·29 per cent.; so that, at the beginning of expansion, we have ·99305 lbs. steam at 165 lbs. absolute pressure, and at the end of the expansion ·82136 lbs. steam and ·17169 lbs. water at 6 lbs. absolute pressure. Then, heat received = total heat of ·99305 lbs. steam at 165 lbs. absolute pressure = 1216·974 thermal units. Heat rejected = total heat of ·82136 lbs. steam at 4 lbs. absolute pressure = 953·29 thermal units + heat of ·17169 lbs. water at same temperature = 26·339 thermal units. Total heat rejected = 953·29 + 26·339 = 979·629 thermal units.

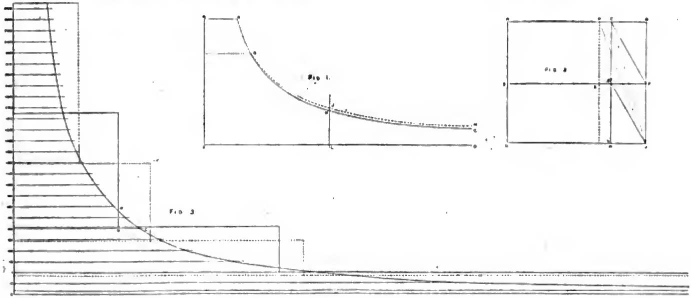
1216·974 — 979·629 = 237·345 thermal units utilised.

Heat utilised with steam of 115 lbs. absolute pressure = 201·088 thermal units.

Heat utilised with steam of 165 lbs. absolute pressure = 237·345 thermal units.

$$\frac{237\cdot345 - 201\cdot088}{201\cdot088} \times 100 = 18$$ per cent. economy of 165 lbs. steam over 115 lbs. steam.

Passing on now to the second alleged cause of the economy of the triple-expansion engine, the general effect of cylinder condensation is to cause a lowering of temperature at the beginning of the stroke and a raising of temperature at the end of the stroke, as indicated by the heat diagram, Fig. 1. A B C D E represents the heat diagram of an engine in which there is no initial condensation, B C being an adiabatic curve produced down to the zero of temperature. The heat diagram



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[*] Read before the North-East Coast Institution of Engineers and Shipbuilders.

of an engine in which initial condensation takes place is indicated by F G H D E, A B G F representing the amount of heat stored up in the walls of the cylinder at the point of cut-off. By the principle of work the area under the curve A B C is equal to the area under the curve F G H, so that if the process were carried down to the zero of temperature there would be no loss from cylinder condensation; but as in practice the process must be stopped at a point J, say, the difference between the areas A B G F and G J K will represent the amount of loss due to condensation. Or suppose 2 lbs. of steam are admitted to a cylinder at 100 lbs. pressure, and that 1 lb. is condensed on the cylinder surfaces, then let the steam be expanded down to 50 lbs. pressure, assuming that all the condensed steam is by that time re-evaporated. Divide the period of expansion into any number of stages. At the beginning of expansion there is 1 lb. of steam at 100 lbs. pressure, and by expanding it down to 50 lbs., a certain amount of energy can be extracted to do external work.

(To be continued.)

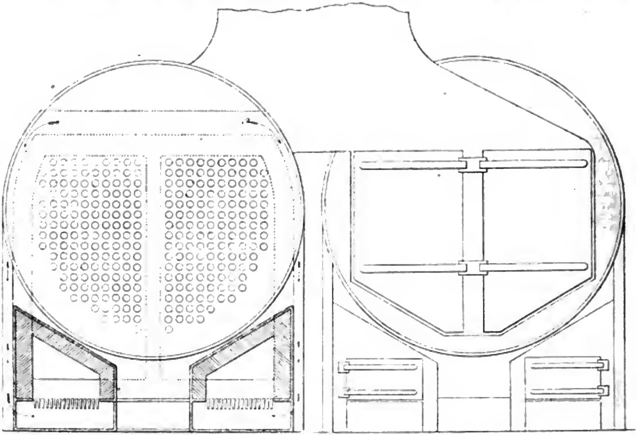


Fig. 4.

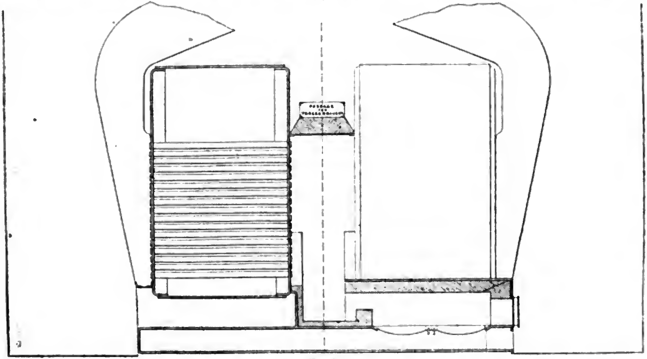


Fig. 5.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Whitefield.—On November 24th there was launched from the shipbuilding-yard of Messrs. John Readhead & Sons West Docks, South Shields, a steel screw steamer of the following dimensions, viz., 290 ft. by 40 ft. by 22 ft. 6 ins. moulded, and classed 100 A 1 at Lloyd's under special survey. The vessel is of the improved well-deck type, having poop aft long extended bridge amidships, and topgallant forecastle, and is fitted with four steam winches, water ballast on the cellular system, Clarke, Chapman's patent windlass, and all the latest appliances and improvements to fit her for general cargo purposes. She has a deadweight capacity of about 3,700 tons. The machinery, also built by Messrs. John Readhead & Sons, is of the triple-expansion type, having cylinders 23 in., 37½ in., and 61½ in. by 39 in. stroke, and is supplied with steam from two steel boilers at a pressure of 160 lbs. per square inch. The steamer has been built to the order of Messrs Maclean, Doughty & Co., West Hartlepool, under the inspection of Mr. H. Abey, superintending engineer for the company. The vessel was named the *Whitefield* by Miss Mabel Pera Maclean, daughter of the managing owner.

Cabo Prior.—On November 25th there was launched by Messrs. J. L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of Messrs. Ybarra y Cia, of Seville. The vessel is intended for the Spanish coasting trade, and has been built under special survey for Lloyd's highest classification. The engines and boilers are being built by Messrs. Blair & Co., and are of the triple-expansion type, having cylinders 15·5 in., 26 in., and 42 in. respectively, with a stroke of 30in. The vessel was named *Cabo Prior.*

Glenisle.—On November 26th Messrs. Edward Withy & Co. launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. Livingston, Conner & Co., of West Hartlepool. The vessel is 280 ft. in length, and built throughout of Simens-Martin steel, with a large measurement and deadweight carrying capacity, and built to the highest class at Lloyd's. The ship has a long raised quarter-deck, short poop, long bridge-house, and a topgallant forecastle. All decks, deck erections, skylights, bulwarks, bulkheads, grain divisions, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. The bulwarks in fore well are 4 ft. 6 in. high; boiler casings, 7 ft. high, and the boats are carried on beams. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, patent windlass on forecastle deck, stockless anchors hauling up into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin is handsomely finished in polished hardwood with painted panels executed in oils by the decorative staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner, with iron polemasts, and has been constructed under the personal supervision of Captain Conner. The vessel will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the vessel was gracefully christened *Glenisle* by Miss Conner, daughter of one of the partners.

Heighington.—On November 26th Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, which has been built to the order of the Hudson Shipping Co., Limited, of West Hartlepool. The vessel is 324 ft. long over all, 40 ft. 6 in. beam, and 23 ft. 8½ in. depth, moulded, having a deadweight capacity of 4,350 tons, and will class 100 A1 at Lloyd's. The deck erections consist of a poop, long raised quarter-deck, long bridge, and topgallant forecastle. The saloon, state rooms, and captain's and officers' rooms will be aft, the engineers' accommodation amidships, and that for the crew in the fore part of the bridge. The hull is built with web frames, and double bottom for water ballast under each hold, and a full equipment will be provided, including steam winches, steam steering gear amidships, screw gear aft, direct steam capstan windlass (Emerson, Walker's patent), two donkey boilers, boats on beams overhead, telescoping topmast, &c. The Central Marine Engine Works of Messrs. W. Gray & Co., Limited, supply the engines, which are of the triple-expansion type of 1,200 H.P., and two large steel boilers to work at a pressure of 160 lbs. per square inch. The steamer was gracefully christened *Heighington* by Mrs. Henry Inchbold, of Inchroyd, Leeds, wife of the chairman. The *Heighington* has been built under the personal superintendence of Captain Blacklin, manager of the Hudson Shipping Co., Limited.

Renwick.—On November 27th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. Fisher, Renwick & Co., of Newcastle, and of the following dimensions, viz:—Length, 180 ft.; breadth, 28 ft.; depth, 14 ft. 6 in., and to class 100 A1 at Lloyd's, on the raised quarter-deck principle. This vessel has water ballast fitted, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including three double-cylindered steam winches, large donkey boiler, and Hastie's steam gear aft. The engines, which are to be supplied by the North-Eastern Marine Engineering Co., Limited, are of the triple-expansion type, having cylinders 13½ in., 22½ in., and 36 in. by 27 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was gracefully named the *Renwick* by Mrs. Fisher, of Loughbrow Park, Hexham.

Lawang.—On November 27th Messrs. C. S. Swan & Hunter launched from their East yard the steel screw steamer *Lawang*, sister ship to the *Tosai*, launched last month for the same owners, Messrs. the Deutsche Dampfschiffs Rhederie, of Hamburg, for their newly inaugurated Sunda Line from Hamburg and Rotterdam to Java and adjacent ports. The vessel is 312 ft. over all, by 41 ft. by 24 ft. moulded depth, with long full poop and long bridge-house amidships, the bridge and poop being connected by a wide house with extended deck to side, the whole of the poop and house being sumptuously fitted for first-class passengers. In the poop deck-house there will be a handsome music saloon with stained glass window and dome skylight, also smoking saloon, fitted in marble, and indiarubber tiled floor. Topgallant forecastle is fitted for crew and petty officers. Electric light will be fitted throughout, with all the latest improvements for the rapid loading and discharging of cargo. The engines are by the Wallsend Slipway & Engineering Co., Limited, capable of indicating 2,500 H.P. The vessel is built on very fine lines, and a high rate of speed is expected. During construction the hull has been under the superintendence of Captain Schultz, and engines under that of Mr. Henert. The vessel will have the highest class at Lloyd's, built under special survey, and in accordance with the German laws, and she was named by Mrs. Henert, of Hamburg, *Lawang.*

Llanthony Abbey.—On November 27th Messrs. Ropner & Son launched from their North Shore shipyard at Stockton-on-Tees a steel screw steamer, built to the order of Messrs. Pyman, Watson & Co., Cardiff. Her dimensions are as follows:—Length, 290 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 10 in. She has been built to the highest class at Lloyd's, and is designed to carry 3,600 tons deadweight; she has a break poop, in which is fitted a handsome saloon with accommodation for officers and captain; raised quarter-deck, long bridge extending to foremast, short well and topgallant forecastle, cellular bottom for water ballast, four steam winches, multitubular donkey boiler, direct steam windlass, and steam steering gear. Being built on the web-frame principle, her holds will give large stowage for cargo, and her outfit includes all the latest appliances for rapid loading and discharging. She will be fitted with triple-expansion engines by Messrs. Blair & Co., of 900 I.H.P., and two large steel boilers working at 160 lbs. She was named *Llanthony Abbey* by Miss Ropner, daughter of the builder.

Andrada.—On November 27th Messrs. W. Pickersgill & Sons, Southwick, launched a large steel sailing ship. The vessel has four masts, and the dimensions are:—304½ ft. long, 43 ft. broad, and depth of hold 24 ft.; and of 2,550 gross tonnage. This vessel has been built to the order of Messrs. E. F. & W. Roberts, of Liverpool, under Lloyd's special survey and Bureau Veritas, and was christened *Andrada.*

Katy.—On November 27th a fine iron sailing ship, built to order of Mr. Christian Moller, was successfully launched from the yard of the Southampton Naval Works Co., Limited, at Woolston. She is 275 ft. long, 41 ft. broad, 25 ft. 4 in. in depth, and of 2,250 gross tonnage, capable of carrying 3,400 tons cargo. The ship was named *Katy* by Mrs. Coates, wife of the company's chairman. This being the first vessel launched from these works since the acquisition of the extensive premises by the present company, the chairman and directors invited a large party, including several ladies, to a luncheon, a special train taking the London contingent of visitors to the Woolston Station, and conveying them back in the evening. In the interval between the launch and the luncheon the company were taken over the works. At the luncheon which followed the chair was occupied by Major E. P. Coates (chairman of the Company), supported by Mr. Beckett Hill (deputy chairman), Mr. J. H. Biles (general manager), Mr. W. H. White (Director of Naval Construction), Colonel Wemyss, Mr. Alderman Bance (Mayor of Southampton), Captain Muus (commander of the *Katy*), &c. In a brief speech, in response to the toast of "The Navy," Mr. White augured success to the new company, and spoke in the highest terms of the professional ability and skill of their manager, Mr. Biles, who some years ago was a student under his care. "Success to the *Katy*" was proposed by the chairman, who mentioned that the company was now paying for wages only irrespective of all other outlay, at the rate of £100,000 per year. He was glad to say that they had several ships now on the stocks in various stages of construction, and were also receiving new orders. The toast was acknowledged by Captain Muus. In responding to a later toast, "Success to the Southampton Naval Works," the manager, Mr. Biles, referred to their eligible situation, with so much valuable water frontage, and also to the double tides, for which the Southampton water was notable—an advantage that enabled them that day to launch the *Katy* an hour-and-a-half after high water.

Europe.—On November 27th there was launched from the Jarrow Yard of Palmer's Shipbuilding and Iron Co., Limited, a large and powerful screw steamer of the following dimensions:—Length over-all 449 ft.; length between perpendiculars, 435 ft.; breadth, moulded, 48 ft.; depth, moulded, 35 ft. 9 in. She will carry about 7,000 tons. The vessel has been built to class 100 A1 at Lloyd's, but has much heavier scantlings than those required by Lloyd's. The vessel has been constructed on the spar-deck principle, having steel spar, main, and lower decks running right fore-and-aft, and sheathed with pine. The vessel will be rigged as a four-masted schooner, with yards and square sails on the foremasts. Accommodation is provided in the 'tween decks amidships for the captain, officers, engineers, and a few passengers, while the accommodation for the crew and firemen is fitted up forward. Provision for water ballast is fitted in a double bottom on the cellular system all fore and aft. The steamer has special appliances for ventilation, &c., suitable for the cattle trade, and will be fitted throughout with the electric light. She will be furnished with all the most modern improvements, including Clarke, Chapman & Co.'s patent direct steam windlass, Harrison's patent steam-steering gear, &c. The vessel has been built to the order of the National Steam Shipping Co., Limited, of Liverpool, and during construction was inspected by Mr. Arnold, the company's surveyor. As the vessel left the ways she was christened the *Europe* by Madame Alcala Galiano, the wife of the Spanish Consul at Newcastle.

Hawkes Bay.—On November the 27th the steamer *Hawkes Bay* was launched from the yard of Messrs. W. Doxford & Sons, Sunderland. Her dimensions are 400 ft. by 48 ft. by 33½ ft.; deadweight capacity, 6,500 tons; gross register, 4,500 tons. The fore-and-main holds are fitted for the carriage of frozen meat.

Gulf of Florida.—On November 27th Messrs. R. & W. Hawthorn, Leslie & Co., Limited, launched at Hebburn-on-Tyne a steel screw steamer, built to the order of the Greenock Steamship Co., Limited, of Greenock, for their Gulf line of steamers. She is of the following dimensions:—324 ft. by 42 ft., by 26 ft. moulded, having a deadweight carrying capacity of 4,200 tons; and her machinery, with triple-expansion engines of 24 in., 38 in., and 62 in., by 45 in. stroke, is also supplied by the company from their engine works at St. Peter's. The vessel was named the *Gulf of Florida*.

Orient.—On November 29th Messrs. Bartram, Haswell & Co. launched from their shipbuilding yard at the South Dock, Sunderland, a finely-modelled screw steamer for the Societadi Navigazione à Vapore Oriente, of Fiume. The following are the principal dimensions:—Length, 285 ft.; breadth, 38 ft.; depth, 22 ft. She has been built of Siemens-Martin steel, under special survey, to take the highest class in Lloyd's Registry, and is of the raised quarter-deck type, with a partial awning deck forward of engine-room, and a poop aft, handsomely fitted up, in polished hardwood, for captain, officers, and a few passengers. The engineers have very comfortable quarters amidships, and the crew are berthed in a roomy forecastle. The double bottom is made on the cellular principle, with four divisions dividing it into tanks for water ballast and trimming purposes. The usual hold beams are dispensed with, and web frames and intercostals fitted instead, in order to keep the holds clear for cargo. The deck machinery includes four large steam winches, supplied with steam from an extra-large horizontal multitubular donkey boiler, Davis's patent combined hand and steam steering gear placed in a teak wheel-house amidships Hastie's patent screw gear aft, Clark, Chapman's patent steam windlass, &c. The vessel will be schooner-rigged, with two steel masts made telescopic to suit the bridges on the Manchester Canal. The electric light will be fitted throughout. The engines are by Mr. John Dickinson, and are of 1,000 I.H.P., the boiler being of steel, and of extra size. During construction the machinery has been inspected by Mr. Macfarlane on behalf of the owners, and the hull and outfit generally by Captain Hall, of Cardiff, and Captain Domini, who will take charge of the vessel when finished. The vessel was named the *Orient* by Miss Bartram.

Naiad.—On November 29th, there was launched from the yard of the Naval Construction and Armaments Co., Barrow, the second-class cruiser *Naiad*, being the third launched from the same yard for the British Government. The *Naiad* is one of twenty-nine vessels of a similar class provided for by the Naval Defence Act of last year, and completes the order given to Barrow. She is one of the new type of protected cruisers, being 300 ft. long, 34 ft. beam, by 22 ft. 9 in. moulded depth, having a displacement of 3,400 tons on a mean draught of 16 ft. 6 in. The hull throughout is built of steel, and has been coated with Hartmann's-Rahtjen's composition. The propelling machinery consists of two sets of triple expansion engines capable of developing 9,000 I.H.P. Steam is supplied by five boilers. A distinctive feature of this cruiser is a steel protected deck extending fore and aft. The armament of the ship will consist of two 6 in. breech-loading central pivot guns, six quick-firing 4·7 in. central pivot guns, eight quick-firing 6-pounder guns, one 3-pounder Hotchkiss, and four 5-barrel Nordenfeldt guns. A 9-pounder gun for boat and field purposes will also be secured on deck. In addition to these four torpedo tubes are to be fitted. For controlling the ship in action, a conning tower is fixed on the after end of the forecastle.

Speke.—On December 1st there was successfully launched from the shipbuilding, engineering and repairing works of Messrs T. R. Oswald & Co., Limited, a large steel sailing ship of the following dimensions:—Length, 312 ft.; breadth, 42 ft. 3 in.; depth, 25 ft. 6 in.; register tonnage about 2,800, carrying a deadweight cargo of nearly 4,400 tons. She has been built to Lloyd's highest class under special survey. Has bridge-house amidships for the accommodation of the captain, officers and crew, hood aft over the after steering gear, monkey forecastle for working anchors, with a separate deck-house abaft the foremast for the steam winch, boiler, and galley; Harfield's windlass, which is arranged to work by steam winch as well as by hand power on main and forecastle decks, and is fitted with two sets of steering gear, a powerful screw gear aft and pinion gear in wheel-house on bridge amidships. The vessel is full rigged, the three lower masts, bowsprit and nine yards being of steel. She has been built for Messrs. R. W. Leyland & Co., of Liverpool, and is the tenth Messrs. Oswald have built for Messrs. Leyland. On leaving the ways the ship was gracefully christened *Speke* by Miss Hamilton, of Southampton. After the launch she was taken into the Pill, a natural wet dock adjoining builders' works and placed under the Company's sheers alongside quay for masting.

Oil Rivers.—On December 3rd, Messrs. Sir Raylton Dixon & Co. launched from their Cleveland Dockyard, Middlesbro', a steel screw steamer which has been built to the order of Messrs. Elder, Dempster & Co., of Liverpool. This vessel is built on the three-decked rule, with poop, bridge and forecastle, and is of the follow dimensions:—Length, over all, 324 ft. 9 in.; breadth, 39 ft.; depth, moulded, 27 ft. 5¼ in., with a deadweight capacity of about 4,200 tons. She has spacious saloon and handsome cabin accommodation in central house for 24 first-class passengers, having special ventilation arrangements for hot climates, and will be fitted throughout with the electric light. Her engines will be fitted by Messrs. T. Richardson & Sons, Hartlepool, having cylinders 23 in., 38 in. and 61 in. by 42 in. stroke. On leaving the ways the vessel was named *Oil Rivers*.

Vala.—On Tuesday afternoon, December 9th, Messrs. Richardson, Duck & Co., launched from their yard a steel screw steamer of the following dimensions, viz.: Length over all, 307 ft. 4 in.; breadth (extreme), 40 ft.; depth, moulded, 21 ft. 8½ in. This vessel, which has been built to the order of Messrs. Carlisle & Co., London, is classed 100 A1 at Lloyd's, and has been built under special survey. She has a cellular double bottom, fore and aft, for water ballast, a short poop, long raised quarter-deck, and partial awning deck extending to stem. Captain, officers, and engineers' accommodation is amidships in bridge, and crew are berthed in forecastle. Four steam winches will be fitted with large donkey-boiler, also steam windlass, steam steering-gear, stockless anchor, and every modern appliance for loading and discharging. The engines, by Messrs. T. Richardson & Sons, Hartlepool, have cylinders 22 in., 35 in., and 59 in. by 39 in. stroke; two single-ended boilers, 160 lbs. pressure. The vessel has been superintended during construction by Captain Robertson. The steamer was christened *Vala* by Miss Richardson, of Potto Hall.

9 de Julio.—On December 11th, Messrs. Laird Bros. launched at Birkenhead a twin screw armour-clad ram for coast and river service, constructed for the Government of the Argentine Republic. The vessel was named the *9 de Julio*. She is a vessel of about 2,500 tons displacement and 3,000 I.H.P.

Vera.—On December 11th a new steamer, built to the order of Messrs. T. Marwood & Son, Whitby, was launched from the Whitehall Shipbuilding Yard at Whitby. The steamer is constructed of steel, and is of the following dimensions:—Length over all, 298 ft. 9 in.; length between perpendiculars, 288 ft.; breadth, 38 ft. 2 in.; depth to top of cellular floors, 19 ft. 9 in.; classification, 100 A1 at Lloyd's; triple-expansion engines, direct-acting, by Messrs. Blair & Co., Stockton-on-Tees, 218 H.P.; deadweight carrying capacity about 3,420 tons, with Lloyd's freeboard. The vessel was christened the *Vera*.

Penpol.—On December 12th there was launched from the shipbuilding yard of Messrs. Harvey & Co., Limited, Hayle, a steel screw steamer of the well-decked type, built to the order of Mr. R. B. Chellew, of Truro. The vessel is of the following dimensions:—Length, 276 ft.; breadth, 36 ft. 6 in.; depth, moulded, 21 ft. 3 in.; with a deadweight capacity of 3,100 tons. She is built on the web-frame principle under Lloyd's special survey to class 100 A1. The engines are on the tri-compound surface-condensing principle, with cylinders of 21½ in., 33 in., and 56 in. diameter, and 39 in. stroke. The ship was christened the *Penpol*.

Empress of Japan.—On Saturday, December 13th, the *Empress of Japan*, a large steel twin-screw steamer, built for the Canadian Pacific Railway Co., was launched from the yard of the Naval Construction and Armaments Co., at Barrow, being the second launched from the same yard for this company. A third is at present in course of construction. These vessels are intended to sail from Vancouver to Yokohama, and will cover the distance in considerably less time than it is done at present. She is 485 ft. long over all; 440 ft. between perpendiculars; breadth, moulded, 51 ft.; depth, moulded, 36 ft.; tonnage, 5,700 gross tons. The engines will indicate about 10,000 H.P. The *Empress of Japan* has been built to Admiralty requirements as a cruiser, and can be armed and made ready for duty in a few hours, her guns being stored in readiness at Vancouver and Hong Kong. Her armament will consist of the largest type of 4·7 in. guns. The launching ceremony was performed by Lady Alice Stanley of Preston, daughter-in-law of the Governor-General of Canada. Lord Hartington, at a subsequent lunch, proposed "Success to the *Empress of Japan*," and said that, although these ships would form the connecting link between Canada and Japan and China, the Canadian route would not be so complete and perfect as it was capable of being made until communication was established by a first-class line of vessels between England and Canada direct. He trusted that, through the agency of the Naval Construction and Armaments Co., and by the active exertions of the managing director (Mr. Bryce Douglas), who had recently been to Canada on this very important matter, in a short time a new enterprise would be launched which would open up direct communication with British ports and Canadian Atlantic ports, and thence, by means of the Canadian Pacific Railway and the Grand Trunk Railway, to open up not only steam communication with China and Japan, but with the Australian colonies. Circumstances connected with the State business of this country might, perhaps, somewhat delay the inception of this enterprise, but he had not the slightest doubt that sooner or later this enterprise would be completed, and that the Barrow Co. would play a very considerable part in establishing this very valuable communication. He gave the toast of "The *Empress of Japan*." Mr. Kersey replied on behalf of the Canadian Pacific Railway Co. The chairman proposed "The Health of Lady Alice Stanley," and the Hon. Edward Stanley replied. Mr. Bryce Douglas, on behalf of his company, presented Lady Alice Stanley with a magnificent card-case, on which was emblazoned a view of the *Empress of Japan*, as a souvenir of the launching.

Salvor.—On December 13th Messrs. Edward Finch & Co., Chepstow, launched an iron screw tug—the *Salvor*—built to the order of Messrs. Tucker & Co., of Cardiff, for sea towing and salvage purposes. Her dimensions are:—Length between perpendiculars, 75 ft.; breadth, 15 ft.; depth in hold, 9 ft. 1 in. She has been built under Lloyd's special survey to class 100A. in Lloyd's Register. Her machinery consists of a pair of compound surface-condensing engines, having cylinders 15 in. and 30 in. diameter by 20 in. stroke, and working at a boiler pressure of 100 lbs.

Cornhill.—On December 13th Messrs. Robert Stephenson & Co. launched at Hebburn the steel screw steamer *Cornhill*, which they have built and engined for the Warkworth Steamship Co., of Warkworth Harbour, Northumberland, and Newcastle-on-Tyne. She is of the improved well-decked type, with a sunk poop, raised quarter-deck, long bridge, and topgallant forecastle. Her dimensions are:—Length, 203 ft.; beam, 31½ ft.; depth, 14½ ft.; and she will carry about 1,100 tons deadweight on a light draught of water. She is to be classed 100 A1 at Lloyd's for hull and machinery. There is a double bottom all fore and aft, and the vessel has been specially strengthened to enable her to load aground. All her deck fittings and the mechanical appliances on board are of the most recent type, she has commodious and well-finished cabins for the accommodation of the officers and crew, and in all respects is fitted up as a first-class cargo steamer. Her propelling machinery, which has been constructed at the engine works of Messrs. R. Stephenson & Co., South Street, Newcastle, consists of a set of triple-expansion engines of about 700 I.H.P., and all the latest improvements are embodied in their design. In the engine-room seven of Mason's patent skylights have been fitted. In the saloon twelve skylights, and several have been adopted elsewhere in the vessel. Both ship and machinery have been built under the superintendence of Mr. A. Taylor, consulting engineer, of Newcastle. The christening was performed by Miss Noble, daughter of B. Noble, Esq., of Gloucester House, Newcastle.

Steam Trawler.—On December 13th Messrs. Cochrane, Cooper & Schofield, launched at Grovehill, Beverley, an iron steam trawler built by them for the British Steam Fishing Co. of Hull.

Holkar.—On December 13th Messrs. Wigham Richardson & Co. launched from their Neptune Shipyard, Newcastle-on-Tyne, a finely-modelled steel screw steamer, which has been built for Messrs. George Tweedy & Co., of London, and is the tenth boat built for them by these builders. The vessel has been built under special survey to class 100A1 at Lloyd's on the spar-deck rule, and will carry nearly 5,000 tons of cargo besides 500 tons of coal in the bunkers. She is fitted with sidelights in the 'tween decks, so that emigrants may be carried; she has also shifting boards for grain cargoes, and the masts are so arranged that she is able to easily pass under the various bridges on the Manchester Ship Canal. She is also specially fitted up for the cattle trade, and will carry about 600 head of cattle. The engines (also by Messrs. Wigham Richardson & Co.) are of the four-crank quadruple-expansion type (Tweedy's patent), and are fitted with all the most approved modern appliances for facilitating their working. The vessel is well equipped with machinery, both for working the ship herself and for loading and discharging the cargo, including steam windlass, steam steering gear, and four steam winches. The vessel was named the *Holkar*, the christening ceremony being performed by Miss Christie, of Tynemouth. After her completion the *Holkar* will, in conjunction with the *Fonar* (s) and *Enskar* (s), both recently built for Messrs. George Tweedy & Co. by Messrs. Wigham Richardson & Co., be placed on their line between London and Philadelphia.

R. Passmore.—There has been launched from the shipbuilding yard of Mr. J. Garside, on the Humber, a ketch schooner of the following dimensions:—Length, 93 ft.; length of beam, 20 ft. 3 in.; depth of hold, 9 ft. 3 in. The vessel, which was named the *R. Passmore*, is specially built for Captain David Foreman and Mr. John Fell, Fifeshire, for the potato trade between Scotland and London.

LAUNCHES—Scotch.

America.—On November 26th, the steamer *America*, the largest vessel which has yet been built at Dundee, was successfully launched from the yard of Messrs. Gourlay Brothers & Co., in presence of a large assemblage of spectators. The *America*, which has been built to the order of the National Steamship Co. of Liverpool, is a beautifully-modelled vessel of the following dimensions:—Length over all, about 450 ft.; breadth, moulded, 46 ft.; and depth moulded, 35 ft., 9 in. The vessel, which has been constructed of steel, and on the cellular double-bottom principle for water ballast, has been built in order to meet the requirements of Lloyd's 100 A class, and has a gross tonnage of about 5,089 tons, her deadweight capacity being about 7,000 tons. She has three decks of steel, wood covered, and is also provided with a spar-deck. Her appliances for the rapid working of the cargo, &c., are all of the latest and most approved character. These include a steam winch at each of the six hatches; a steam capstan, a windlass forward for the working of the anchors and the warping of the vessel, and steam steering gear amidships, by Harrison. The *America* is mainly intended for the emigrant and Atlantic cattle-carrying trades, and her ventilating arrangements are of a special character. Provision is made amidships for the berthing of the captain, officers, passengers, and engineers, while the crew will be accommodated forward, and the cattlemen and petty officers aft. The vessel, which took the water in fine style, was named by Miss Gordon, Ferry House, Broughty Ferry. After the launch the vessel was towed round to the Victoria Dock for the purpose of receiving her engines and boilers. The engines will indicate about 3,000 H.P., and give a speed of about 12 knots.

Tordenskjold.—On November 26th the Grangemouth Dockyard Co. launched, from their Alloa yard, a handsomely-modelled steam barque (built to the order of Messrs. Lindviz, Kragero, Norway) of the following dimensions:—Length, 185 ft. between perpendiculars, by 32 ft. moulded breadth, and 17 ft. 6 in. moulded depth. The vessel has been constructed to carry 1,200 tons cargo, and is built to Norwegian Veritas rules under special survey and superintendence of Captain Falkenberg. The vessel was christened the *Tordenskjold*.

Scottish Bells.—On November 26th, a fine steam trawler, named the *Scottish Bells*, was launched from the shipbuilding yard of Messrs. John Scott & Co., Abden, Kinghorn. She was launched with steam up, and she at once steamed on a trial trip up the Firth, afterwards being moored in Burntisland Harbour for the purpose of taking in coals and being finished. The vessel, which is built of steel throughout, is for Messrs. Brown & Co., Aberdeen, for whom Messrs. Scott have already built two similar vessels.

Hopper Dredger.—On November 27th Messrs. Wm. Simons & Co., Renfrew, successfully launched from their works a steam hopper dredger constructed to the order of the Alcoy & Gandia Railway & Harbour Co. The machinery has all been completed in the vessel previous to launching, and is similar to that recently supplied to the Nicaragua Canal. The hopper has a capacity to contain 400 tons of dredgings and the buckets have a lifting capacity equal to filling this in one hour in ordinary material. The bucket ladder dredges to a depth of 35 ft. under water. Triple-expansion engines are fitted for driving the propelling and dredging machinery. The builders' patent raised bow and forecastle is provided for the additional strengthening of the vessel at bow and also to enable the buckets to dredge in advance and cut their own flotation and to work close to the foot of quay walls. The dredger has been built under the direction of Sir James Brunlees, Sons & McKerrow, and is expected to leave in a few days for its destination.

Duke of Portland.—On November 27th the Grangemouth Dockyard Co. launched a steel screw steamer of 2,200 tons deadweight for Messrs. James & Alex. Wyllie, of Troon. She was named the *Duke of Portland*. The dimensions of the *Duke of Portland* are as follows:—Length, 258 ft., over all, by 35 ft. beam, 19 ft. deep. Engines, which are of the triple-compound type, are being supplied and fitted on board by Messrs. Hutson & Corbett, of Kelvinhaugh Works, Glasgow.

Breidablik.—On November 28th Messrs. Russell & Co. launched from their Kingston Yard, Port-Glasgow, a four-masted steel barque of 2,380 tons, to carry 3,800 tons deadweight. Dimensions—Length, 283 ft. by 43 ft. by 24 ft. 3 in. This vessel is named *Breidablik*, and is to the order of Messrs. Bruüsgaard, Kjösterud & Co., Drammen, Norway. Built to Lloyd's highest class, and Norwegian Veritas Captain Arusen superintended construction, and will command the vessel.

Holguin.—On November 29th there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a finely-modelled steel twin-screw steamer of the following dimensions: Length, 195 ft.; breadth, 28 ft.; depth, moulded, 20 ft. 2 in. The vessel has been built to the highest class in Bureau Veritas, and is intended for passenger and fruit trade between New York and South America, and will attain a high rate of speed. Her holds are specially adapted for the safe carriage of fruit in equal temperature. On the vessel leaving the ways, she was gracefully named *Holguin* by Miss H. L. Murray, daughter of one of the partners of the firm. After the launch the vessel left in tow for Glasgow to receive her engines, which are supplied by Messrs. Muir & Houston, and are of the triple-expansion type, cylinders 14 in., 23 in., 36 in. by 24 in. stroke, working at 160 lbs. pressure. She will be followed in a fortnight by a sister ship, both built to the order of Mr. Jacob Christensen, Bergen. The vessels are under the direct superintendence of Captain K. Reimers. A large company afterwards sat down to cake and wine in the model-room of the firm.

Balmoral Castle.—On November 29th there was launched from the shipbuilding yard of Messrs. John Scott & Co., Kinghorn, a fine screw steam trawler built to the order of Messrs John Barclay & Co., Aberdeen. The vessel, which was launched with steam up, required no tug to assist her, but steamed up the Firth of Forth to Burntisland, where she will be finished and take in coal. On leaving the launching ways she was named the *Balmoral Castle*. This was the second vessel launched from Kinghorn shipyard in the same week, both being trawlers for Aberdeen. The *Balmoral Castle* is expected to attain a high rate of speed.

Frias.—On December 1st Messrs. Fleming & Ferguson, Paisley, launched from their yard the twin-screw dredger *Frias*. This dredger is fitted with two pairs of the builders' patent quadruple-expansion engines to indicate 500 H.P., and is capable of raising 600 tons per hour from a depth of 30 ft., and is so designed as to enable it to cut in front and make its own flotation. This is the third dredger built by the firm for harbour works at Buenos Ayres, which are being completed by the executors of Mr. T. A. Walker, contractor for the Manchester Ship Canal.

Socotra.—On December 1st Messrs. Russell & Co. launched a large three-masted steel sailing ship named the *Socotra*, built to the order of Messrs. P. Denniston & Co., Glasgow. The following are her dimensions:—Length, 260 ft.; breadth, 38 ft.; depth, 23 ft.; 1,700 tons net register, to carry 2,860 tons deadweight. This vessel has been built under the superintendence of Captain De Witt, and will be commanded by Captain Raeberon. She will fit out in Port-Glasgow, and take in cargo at Glasgow.

North Coast and North Wind.—On December 9th two new steam screw trawlers, named the *North Coast* and *North Wind*, were launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen. They have been built to the order of Mr. William Pyper and others.

Highland Lassie.—On December 9th Messrs Mackie & Thomson launched from their yard at Govan a steel screw steamer of 2,470 tons gross register, built to the order of Messrs. James Nelson & Sons, London and Liverpool. The vessel is 295 ft. in length by 40 ft. 24·9 ft., moulded, to class 100 A1 under Lloyd's special survey, with a full poop aft for captain, officers, and passengers; long bridge amidships, covering engines, boiler, and refrigerating machinery, topgallant forecastle, &c. Upon leaving the ways the ceremony of naming the vessel the *Highland Lassie* was performed by Mrs Mackie, 4, Broomhill Terrace, Patrick, after which the company joined in the usual toasts. The engines are being fitted by Messrs. Dunsmuir & Jackson, Govan, and are of the triple-expansion type—22 in., 34 in., and 56 in. by 39 in., with two steel boilers (160 lbs. pressure), large donkey boiler, and an auxiliary boiler for working the refrigerating machinery. The vessel is being specially fitted throughout for the dead-meat trade between this country and the South American ports, where Messrs. Nelson have large storage accommodation, fitted with refrigerating chambers. The vessel is insulated in both upper and lower holds, and the refrigerating machinery, which is being supplied by Messrs. J. & E. Hall, Limited, London and Dartford, will be capable of dealing with 100,000 carcases, this number being the vessel's full cargo capacity.

Dredger.—On December 11th Messrs. Lobnitz & Co. launched at Renfrew a powerful dredger for the Danube. This vessel is of special construction in hull and machinery for lifting the rock dislodged by Lobnitz's patent rock-cutters lately supplied for the Iron Gate.

Invergarry.—On December 11th there was launched by Messrs. A. M'Millan & Sons, Dumbarton, a barque of about 1,350 tons. The dimensions are:—238 ft. long, 36 ft. broad, and 21 ft. 6 in. deep. She has been built to the order of Messrs. George Milne & Co., Aberdeen, and was named the Invergarry.

Thetis.—On December 13th Messrs. J. & G. Thomson, Limited, launched at Clydebank the *Thetis*, the second of three second-class protected cruisers they are at present constructing for the British Government. The dimensions of the vessel are as follows:—Length, 300 ft.; breadth, 43 ft.; depth to the upper deck, 22 ft. 9 in. Her displacement is 3,400 tons, with a mean draught of 16 ft. 6 in. As it is of primary importance that vessels of the protected cruiser class should be fast the *Thetis* and her sister ships have been constructed to attain a speed of from 18 to 20 knots an hour. Her propelling machinery consists of two sets of vertical inverted triple-expansion engines, supplied with steam at a pressure of 155 lbs. to the square inch by five cylindrical steel boilers. In the construction of the engines both cast and wrought steel have been largely utilised with the view of giving great strength, combined with lightness, to the moving parts of the machinery. The two propellers will be of naval brass. The coal supply at the load draught will be 400 tons—sufficient to enable the vessel to steam at the ordinary cruising speed of 10 knots for a distance of 8,000 knots. The *Thetis* is coated with Hartmann's Rahtjen's composition.

Oldenburg.—On December 13th the Fairfield Shipbuilding and Engineering Co., Limited, launched the *Oldenburg*, a steel screw steamer of 5,400 tons, built to the order of the Norddeutscher Lloyd, of Bremen. Her dimensions are:—Length over all, 430 ft. 10 in.; breadth, moulded, 48 ft.; depth, moulded, 33 ft. The ship will have accommodation for about 42 first-class, 36 second-class, and 2,100 third-class passengers, besides ample accommodation for officers and crew. Her engines are of the inverted triple-expansion type, with cylinders 31 in., 52 in., and 83 in. in diameter, and a stroke of 4 ft. 6 in. Steam will be supplied by two double ended and two single-ended boilers, each of steel and corrugated. The boilers have been constructed for a working pressure of 150 lb. per square inch.

Princess Irene.—On December 13th Messrs. W. B. Thompson & Co., of Dundee, launched a steamer, named the *Princess Irene*, of 750 tons gross, which has been built to the order of Messrs. M. Langlands & Co., of Liverpool, was intended for the passenger and general trade between Dundee and Liverpool.

Iris.—On December 13th Messrs. Blackwood & Gordon launched from their shipbuilding yard, at Port-Glasgow, a handsome steel twin-screw steamer named *Iris*, of 1,500 tons gross tonnage and 260 ft. in length, to the order of Messrs. Hill, Gomes & Co., for South American trade. She is fitted with two sets of triple-expansion engines of 1,700 I.H.P. She is coated with Hartmann Rahtjen's composition.

Erato.—On December 15th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun the *Erato*, a steel sailing ship of 1,783 tons, built for foreign owners. Her dimensions are:—Length, 256 ft.; breadth, 40 ft., depth, 23 ft. She has been built to the highest class at Lloyd's. After the launch the vessel was towed to Clydevilla crane, where her masts and yards will be fitted on board.

Ottawa.—On December 16th Messrs. Alexander Stephen & Sons launched at Linthouse a fine steel screw steamer, 275 ft. by 35 ft. by 23 ft. 11 in., about 1,900 tons gross, and of 100 A1 spar deck class, with accommodation in bridge house for about 33 first-class passengers—the officers being also located amidships and the crew under spar deck forward. The vessel is fitted with Messrs. Stephen's triple-expansion engines, having cylinders 22 in., 35 in., and 58 in. diameter by 42 in. stroke and a working pressure of 160 lb., and has all the most modern and approved appliances for rapid and effective service. She is the fifth steamer supplied by Messrs. Stephen for Mr. C. Furness, West Hartlepool, and is intended by him for the trade between this country and Nova Scotia, Newfoundland, &c., in which two of these, the *Damara* and *Ulunda*, have been engaged, and proved themselves most efficient and successful. The new steamer was gracefully named the *Ottawa* by Miss Mabel Young, 8, Claremont Terrace.

Nordlyset.—On December 16th Messrs. Russell & Co. launched from their Greenock yard a sailing barque of 2,500 tons gross for Messrs. Bruüsgaard & Kjösterud, of Norway. She is named the *Nordlyset*, and after fitting out, will load a general cargo at Greenock for Brisbane. Dimensions:—Length, 250 ft.; breadth, 38 ft.; depth, 21 ft. 6 in.

LAUNCHES—Irish.

British Crown.—On the 29th November there was launched from the Queen's Island Shipbuilding Yard, Belfast (Messrs Harland & Wolff), a fine steel screw steamer, built to the order of the British Shipowners' Co., Liverpool, and which will be fitted up for the cattle trade. Her machinery will be of the triple-expansion type, with two large double-ended steel boilers, working at 180 lbs. pressure. She is expected to leave here early in January.

Eveleen.—On December 15th at high water there was launched from the Belfast Shipyard (Messrs. Workman, Clark & Co., Limited), a fine steel screw steamer, built to the order of Mr. John Milligen, Donegal Place, Belfast, for his coal trade between Belfast and the English ports. The *Eveleen* is of the well-deck type, and capable of carrying 600 tons. Her machinery will be a set of triple-expansion engines, capable of 750 I.H.P., and working at a boiler pressure of 160 lbs. The engines and boiler will be fitted by Messrs. Muir & Houston, Glasgow, where she will be towed to receive it. The hull and machinery have been constructed under the superintendence of Mr. Joseph Lewis, consulting engineer, Donegal Quay, Belfast.

LAUNCH—German.

Furst Bismarck.—On November 29th the steamer *Furst Bismarck* was launched from the Vulcan Company's yard, near Stettin, for the Hamburg-American Packet Company. She is the biggest vessel ever built in German yards, and the largest as yet under the German flag. This boat is 502 ft. long, 57 ft. wide, and 38 ft. deep. She is built of steel, to the highest class of the Bureau Veritas, and is divided by bulkheads into 12 water-tight compartments. She is rigged as a schooner with two masts, and has a pair of three-bladed propellers worked by two independent sets of triple-expansion engines of (together) 14,000 I.H.P. Her crew will number 360 men, and she is fitted for about 400 first-class, about 170 second-class, and about 700 'tween deck passengers.

TRIAL TRIPS.

Gyda.—On November 24th the screw steamer *Gyda*, built by Messrs. Wood, Skinner & Co., of Bill Quay-on-Tyne, to the order of Mr. Isakson, of Christiania, went to sea for a trial trip. The vessel is of the following dimensions:—Length, 230 ft.; breadth, 33 ft.; draught, 16 ft. The engines, having cylinders 17 in., 28 in., 46 in., and 30 in. stroke, having been built by the North-Eastern Marine Engineering Co., Limited, Wallsend, and constructed to the survey of Norwegian Veritas. The sea was too rough to obtain any speed trials, but throughout the trial the working of the machinery gave the greatest satisfaction.

Adriane.—On November 24th the large new screw steamer *Adriane* left the Tyne for a trial trip. This steamer has been built by Messrs. Swan & Hunter, of Wallsend-on-Tyne, to the order of Mr. Kirston, of Hamburg, on behalf of the Hamburg-Pacific Steamship Co., and is of the following dimensions, viz.:—Length, 324 ft.; breadth, 40 ft.; draught, 22 ft. 4 in. The engines have been constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, and have cylinders 26 in., 42 in., 39 in., and 45 in. stroke, and two large single-ended boilers. During the trial, which took place in very rough weather, the engines ran beautifully, and without a hitch of any kind.

St. George.—On November 26th the new 850-ton composite auxiliary steam yacht *St. George* went out on her trial trip on the Firth of Forth, with the most satisfactory results. Although the weather was unpropitious, and snow squalls frequently closed round the vessel, still after the compasses were adjusted a full speed long distanced run was obtained, when she showed a speed of fully 12¼ knots, with the engines running at 104 revolutions per minute. The machinery worked with the greatest smoothness, and to the entire satisfaction of those in charge. The *St. George* is probably the strongest and best equipped yacht afloat, and has been built specially for cruising to the most distant and inaccessible parts of the world. Being heavily rigged as a barque, her speed under canvas is expected to be exceptional, while the propeller, which is one of the largest Bevis patent ever made, can be feathered into the screw aperture, so as not to hinder the vessel's progress. The *St. George* is owned by Mr. Ernest J. Wythes, of the Royal Yacht Squadron, has been designed by Mr. W. C. Storey, of London, and has been built and engined by Messrs. Ramage & Ferguson, Leith.

Seal.—On November 29th the steam trawler *Seal*, which has been built by Messrs. Sir Raylton Dixon & Co., Middlesbro' for Mr. G. Alderson Smith, of Scarborough, proceeded on her trial trip. This vessel is built with cabin aft, also accommodation forward, hold for fish and ice, and is provided with all modern appliances for trawling. She is of the following dimensions:—Length, over all, 106 ft. 6 in.; breadth, 20 ft. 4⅝ in.; depth, moulded, 11 ft. 11 in. Her machinery has been fitted by the Vulcan Iron Works Co., Hull, with cylinders 17¼ in., and 34 in. by 24 in., and which gave every satisfaction on trial.

Martin Saenz.—On December 4th this steamer, built by Messrs. Chas. Connell & Co., Whiteinch, after being engined by Messrs. Dunsmuir & Jackson, Govan, and loaded with 3,600 tons deadweight, left Glasgow Harbour, and, after adjusting compasses, went her trial trip in the Channel. The steamer is 355 ft. by 42 ft. by 27 ft. 8 in., has full lines, and is fitted with splendid passenger accommodation. The engines have cylinders 27 in., 43 in., 69 in., by 48 in. stroke, and are supplied with steam from two double-ended boilers 14 ft. dia. by 16 ft. long, working at a pressure of 160 lbs. The engines worked most satisfactorily, and the mean speed on the measured mile at Skelmorlie was 11¼ knots. The party on board, representing owners, builders, and engineers, went on shore at Greenock, and the vessel proceeded on her voyage to Cadiz.

Erling.—On December 6th this steamer, which has lately been fitted by Messrs. Fleming & Ferguson, Paisley, with a set of their patent quadruple-expansion engines, went down the river for trial, and on the measured mile, with 1,200 tons on board, made a speed of 9 knots. The old engines, which have been replaced by the quadruple now tried, only drove this steamer seven knots, with a coal consumption of 15 tons, whilst the quadruple drove her nine on a consumption of eight tons.

Gossamer.—On December 5th the official basin trials of the steel gunboat *Gossamer*, the first of the ships built under the Naval Defence Act, were brought to a successful conclusion at Sheerness Dockyard. The engines were first tested with 50 lbs. pressure of steam, which was gradually worked up to the full pressure of 150 lbs. The engines worked smoothly, without any hot bearings, while the boilers gave a plentiful supply of steam. The *Gossamer* has been fitted with engines made in the steam factory at Sheerness Dockyard from designs prepared at the Admiralty, and considerable interest attaches to her trials, as she is the first ship which has been engined by the dockyard authorities. Orders have been given for the *Gossamer* to be immediately prepared for trials at sea. Her engines have been designed to develop 2,500 H.P. under natural draught, and H.P. under forced draught.

Ching Ping.—On December 12th the handsome steel screw passenger steamer *Ching Ping*, built at Blyth by the Blyth Shipbuilding Co., for Mr. John White, of London, for China account, had a highly satisfactory trial trip. The vessel is 223 ft. in length, has full poop for passengers, and ample accommodation amidships, teak decks, Smith's steam winches, Donkin and Nichol's steam steering gear, and Napier's patent windlass: the cabins being upholstered by Headly & Co., of Blyth. She left the river early in the morning laden, for adjustment of compasses, and during the forenoon a large party of gentlemen were taken by tug to the steamer at sea. A trial of speed extending over several hours was then made, giving results satisfactory to all concerned. The *Ching Ping* was afterwards brought back to Blyth, when after receiving the Chinese crew, she will sail for London, prior to proceeding to China. The engines are by Mr. Middleton Pratt, of Huddersfield; they are of the triple-expansion type, and worked with great smoothness and efficiency. The whole of the work has been under the superintendence of Mr. J. G. Walton, of London, who has also the supervision of two other ships, building by the Blyth Shipbuilding Co., for the same trade.

Gera.—On December 13th the Norddeutscher Lloyd's steamer *Gera* left the Clyde, for Bremerhaven, after going through a series of speed trials in the Firth. The tests were satisfactory in every way, a mean speed of 13·8 knots, or three-fourths of a knot more than that guaranteed, being attained. The *Gera* is the second of four vessels ordered in the beginning of the year from the Fairfield Co., for the North German Co., and is intended for the emigration trade between the Continent of Europe and South America. She has accommodation for 50 first-class passengers, 50 second-class passengers, and 2,500 emigrants. Built of Siemens-Martin steel, she confirms to all the regulations of the Board of Trade, and is classed in the highest class in the Germanischer Lloyd, Berlin. Her dimensions are:—Length, over all, 430 ft.; length, between perpendiculars, 415 ft.; breadth of beam, 48 ft.; and depth, moulded, 36 ft. The gross register is about 5,500 tons. The *Gera* is coated with Hartman's-Rahtjen's composition.

Chelydra.—On December 14th this vessel, 315 ft. 6 in. by 40 ft. 6 in. by 22 ft. 6 in., built by Messrs. J. L. Thompson & Sons, Sunderland, for Mr. C. Hutchinson, of the same town, left Sunderland for her trial trip. Her engines are of the triple-expansion type of 210 H.P. nominal, having cylinders 23 in., 38 in., 62¼ in. in diameter by 42 in. stroke, and working at 160 lbs. pressure of steam. They were built by Messrs. Blair & Co., Stockton. She made a successful run, everything working satisfactorily, and the vessel attained a speed of about 10 knots.

Bellona.—On December 16th the *Bellona*, built and engined by Messrs. Hawthorn, Leslie & Co., Newcastle, arrived at Portsmouth. She made the distance between the Tyne and Dover with open stokeholds, and consequently without any air pressure, at a speed of 10 knots. The engines were afterwards run easily at a 14-knot speed, and it is expected that, when the funnels are raised to the same height as those of the sister ship *Barham*, she will attain a speed of 16 knots without aid-offered draught. The utmost speed she was designed to attain under forced draught was 19½ knots, but the Admiralty has decided to accept her from the contractors without subjecting her to this extreme test.

Reviews.

Waterways and Water Transport in different Countries. By J. Stephen Jeans. E. & F. N. Spon.

THERE is probably not a more interesting and instructive topic for consideration than the transportation of a nation's productions and manufactures. Of late the subject of railways, their rates and charges, &c., have been too prominently before the minds of those interested, and it is with some pleasure that we turn away from it to the perusal of a work upon the history and prospects of transport by water. Mr. Jeans is a well known writer upon economics, and his contribution to the literature of this subject bears the impress of this bias rather than that of the practical engineer. It is, however, a volume that is of some value, and its reading is far from being heavy and uninteresting. The style is, as the writer's preceding works, lucid and facile, and Mr. Jeans has apparently a good grasp of the subject with which he deals. The method of reviewing the canal question adopted here is by a primary division into three sections: the first describes the waterways of different countries; the second discusses the various ship canals of the world; and the third traverses the questions of transport and working. In the introduction and outline explanatory of the object of the work, we have a comprehensive and historical record of the origination and growth of the canal systems of the world. From time almost prehistoric water has been the chief means whereby the commodities of industrial and manufacturing nations have been transported from place to place. Previous to the inception of the first railway, canals, as Mr. Jeans tells us, had it all their own way. It is a common fact that the progenitors of the Egyptian race, even so far back as the thirteenth dynasty, constructed canals for the purpose of augmenting their trade; and in the early annals of history we find that the Italians, the Swedes, the Chinese and other peoples were not backward in adopting this their only means of transport, besides the employment of animals. We have read the book before us with great interest, and it reveals to us the decay, as well as the development, of many systems of canals; and we cannot but remark that in every country except in our own, Mr. Jeans sees a condition of wonderful prosperity in connection with the use of canals. Their systems impress him with their completeness and their admirable condition. France, he says, possesses a "system of water transport—in some respects more complete than that of any other country"; of Germany, "There is perhaps no country that enjoys greater facilities of transport;" of Belgium, "The little kingdom of Belgium enjoys the advantage of having an excellent system of canal transport." Holland has "an extensive system of canals, which cross and interlace each other like the threads of some large fishing net." In Sweden the canal system is "by no means unimportant," in addition to possessing "an admirable system of lakes;" and the canals of both the United States and Canada excite his admiration. But the waterways of our own "sea-girt isle" have been "grievously neglected." It is a question, however, whether, if our canals were made navigable for the passage of larger vessels, they would in any great degree regain their position. The United States has proved that industrialists prefer to make a larger outlay and obtain quicker transport than *vice versa*. From other countries likewise we see how great a preference is given to that system of transmission of produce which affords the least delay in the delivery of goods. Thus we find that in Germany the quantity of traffic on the canals and other navigable ways, was, in 1884, 19½ millions of tons (p. 382), whilst the railways in that country conveyed no less than 107 millions of tons; the former of which had, on Mr. Jeans' own showing, decreased in 1887 to 17½ million tons (p.132), a very enormous diminution, if correct, within two years. In France, likewise, we see that in 1887 the tonnage of traffic "canalised" was 21 millions, whilst the railway was burdened with over 80 millions of tons. There is also in connection with these countries to be considered the fact that a low fee for transport is levied, and that the state has a very great interest in the welfare of the waterways. Amongst the ship canals which are treated with are the Suez, the Panama, the Nicaragua and the Manchester—of each of these there is given a concise account. The history of the first-named nearly every reader is familiar with—its inception, the great opposition and derision with which the proposal was greeted, the optimistic faith of its author in its ultimate success, and finally the marvellous statistical record, alike the admiration of the statistician and the financier. To the tragic and almost hopeless undertaking of the Panama cutting Mr. Jeans allots a space of 40 pages and gives us some interesting data concerning its history. This vast undertaking has already swallowed no less than 35½ millions sterling and it is estimated that some 30 millions will be needed to bring it to completion, if it ever arrives at that stage. The Nicaraguan canal, Mr. Jeans says, is "one of the most important and costly of isthmian canal projects that now looms on the horizon," but the expenditure involved in this case will be far smaller than that incurred in connection with Panama, and the obstacles which present themselves are less. The Manchester Ship Canal, Mr. Jeans regards, (and no doubt rightly in its relation to British trade) as "one of the most remarkable undertakings of modern times." One of the great *desiderata* of large industrial centres is that they should be in close proximity to, if not on, the seaboard, and the only means of accomplishing this, if not a natural endowment, is to bring it within easy reach of the sea by artificial waterways—this is the aim of the Manchester Ship Canal, which is now in course of construction. A short review of the Isthmian canal of Corinth and an inclusion of the River Thames in the category, closes the section, though why this latter should be relegated to this classification more than some other natural rivers, such as the St. Lawrence, the Danube, the Hoang-ho, we hardly know—as it assuredly is not a canal pure and simple. The last section, which will be the most attractive to many, especially perhaps to the statistician, is that dealing with transport and working. Amongst the more important chapters are those on Railways and Canals; on the comparative cost of water and land transport; on speed of transport; on Canal traffic: its character and its density; and on the State acquisition and control of Waterways. These call for much consideration, more especially the last mentioned, which is dealt with somewhat summarily. The appendix also affords tabulated information respecting the canals of the United Kingdom, as well as statistics referring to lakes and rivers of the world. From the midst of all these collected data, unfortunately error has not been entirely eliminated—for instance we find that on page x. of the introduction Mr. Jeans states that £12,000 per mile would need to be expended to put the English inland navigations into order. "This would mean," he says, "for the 3,000 miles of canal already constructed an expenditure of £24,000,000."—this should surely be 36 millions. In the appendix we discover that in table II. the canals of Ireland are not particularised, though in table IV. this country appears to possess a greater canal mileage than Scotland—and in table IV. Wales is not included though given in table II. In the index similarly there are discrepancies which, though trifling, should have caught the eye in revision. Thus Humboldt is indexed for his opinion on the volcanoes of Nicaragua, 317; but his more important remark on p. 276 is unnoticed therein, and other omissions of similar style we notice. In the body of the book Lord Alfred Paget, who we know as an authority on navigation, is denominated in one or two places Lord *Clarence* Paget. The data collected, however, is of a valuable class and worthy of perusal,—and it, no doubt, occasioned much research and labour, and as a work of historical and literary information it should be highly valued by those interested in such vital questions as the transportation facilities of national trade.

Miscellaneous.

Italian Armour Plates.—Experiments have been carried on at the polygon of Muggiano, in the presence of the Italian Minister of Marine, with armour-plates made of a special steel turned out at the Terni Works. The experiments are stated to have been attended with satisfactory results.

130-Ton Crane for Glasgow.—The Clyde Navigation Trustees have placed an order with Messrs. Cowans, Shelden, & Co., Limited, Carlisle, through their agent in Scotland, Mr. J. Monkhouse Cartmell, Glasgow, for a 130-ton steam wharf crane to be erected on Finnieston Quay, Glasgow. It will revolve the entire circle at a radius of 65 ft., and the height from quay level to centre of top jib pulley will be 100 ft. It will be the largest crane of its type in the world.

Vosper & Co.—Messrs. Vosper & Co., engineers and yacht builders, Portsmouth, have just purchased the business of Messrs. Miller, Tupp & Rouse, engineers and yacht builders, Creek Works, Lower Mall, Hammersmith, which will now be conducted by Messrs. Vosper & Co. in conjunction with their business at Portsmouth. Messrs. Vosper have also taken over from Messrs. Miller the patent rights of their "Dolphin" donkey pump.

A Cruiser for the Spanish Navy.—Sir Charles Palmer and his partner, Senor Martinez de las Rivas, are making arrangements for an order for another cruiser of 9,000 tons to be built at their shipbuilding yard at Bilbao. Of course, the Minister wishes to have every novelty and improvement applied to this ship, which is to be one of the most important vessels in the Spanish Navy. The details have not yet transpired.

During the recent trials of the 110-ton guns on board the *Sanspareil* it was discovered that one of the hoops round the centre of the gun was cracked. In spite of this, however, the Admiralty have decided to complete the trials, so as to test the capabilities of the weapon.

Launching of a Mission Steamer at Hong Kong.—Bishop Burdon, of Hong Kong, conducted in August last a dedicatory service at the launching of a new mission steamer in Hong Kong Harbour, to carry the seamen's chaplain and the Missions to Seamen reader to and fro from ship to ship on the waters of that distant port. After three years' patient working and collecting funds, largely from sailors themselves, the mission steamer *Day Spring*, as she was named by a daughter of Sir Henry Parkes, successfully slid off the ways into the waters of Hong Kong Harbour. Thanks to many kind and liberal friends in England and at Hong Kong, the *Day Spring* was launched free of debt, with money in hand for her immediate maintenance. A bottle of pure water was broken on the bows as the vessel slid off, instead of the traditional wine.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from November 16th to December 15th, 1890.

18549 Max Gehre. Super heaters for steam boilers.
18562 C. Wells and J. Willis. Steam engines.
18701 T. Smith, W. H. Smith and W. Eastwood. Steam-engines.
18860 R. McIntyre. Ridge welded boiler flues.
19007 J. T. Milton. Furnace flues for steam boilers.
19027 J. Kerr. Marine boilers
19082 G. Dürr. Water tube boilers.
19137 J. Cameron. Steam boilers.
19138 T. Mudd. Furnace flues for marine boilers.
19149 J. D. Davies. Steam engine indicators.
19212 H. Corden. A steam boiler double coned circulating tube.
19215 L. G. McFarlane. Quadruple expansion engines.
19236 W. James. Light feed lubricators.
19305 W. Thomas. Reversing gear for steam engines.
19392 L. Rushworth and J. M. Livsey. Motive power engines.
19459 F. W. MacDonald. Lubricators (Norbert de Moor, Belgium).
19556 W. C. Morison. Marine sounding apparatus.
19627 C. B. Bosworth Steam boilers.
19719 A. Collingridge. Propulsion of water borne vessels.
19729 C. R. Bonne. Steam generators (A. Svensson, Germany).
19814 W. E. Corrigal. Steam boilers.
19817 A. Liberti. New action of steam in the immission cylinders of engines.
19852 G. P. Spooner. Governing steam engines.
19912 G. J. Stevens. Propeller blades for ships.

BOARD OF TRADE EXAMINATIONS.

Note.—1 C, denotes First Class; 2 C, Second Class.

November 22nd, 1890.

Adamson, J. W. G. 2C Dundee
Bear, John C... 2C Cardiff
Berry, Wm. G. 1C W.Hrtpl
Bodger, Chas. P. 2C ,,
Brasier, Chas... 1C London
Brooks, Thos. H. 1C Cardiff
Butes, Edward 2C London
Clarke, Isaac .. 1C W. Hrtpl
Clncas, John H. 1C ,,
Corsie, M. .. 2C Aberdeen
Cunningham, J. 2C Glasgow
Dall, Richard .. 1C ,,
Fletcher, R. H. 1C L'pool
Fowell, Ridley .. 1C ,,
Galloway, R. W. 2C ,,
Geckie, Alex. D. 2C Dundee
Grantham, C... 1C N.Shields
Gravill, Fred. E. 2C Dundee
Hargrave, Percy 2C W.Hrtpl
Harley, John .. 2C N.Shields
Hean, Alfred .. 2C Dundee
Hill, Fred. E... 2C N.Shields
Howard, Arthur 2C London
Hunter, A. Wm. 2C Aberdeen
James, Wm. .. 1C N.Shields
Johnstone, R. J. 2C Cardiff
Jones, A. P. .. 1C ,,
Jordan, James 1C Glasgow
Keay, James .. 1C Dundee
MacEwan, J. .. 2C ,,
Millar, David .. 1C N.Shield
McDonald, Jas. 2C Aberdeen
McIntyre, J. .. 2C N.Shields
Morton, R. .. 2C L'pool
Nesbit, R. B. .. 1C Cardiff
Noonan, Jas. .. 2C Aberdeen
Patrick, Alex... 1C Glasgow
Pearson, J. E... 2C ,,
Pnllar, David .. 1C Aberdeen
Raisbeck, H. T. 2C L'pool
Rabe, Hans .. 2C ,,
Ripley, Alfred .. 2C W. Hrtpl
Ross, David .. 1C London
Routledge, Wm. 1C Cardiff
Ryan, John .. 1C ,,
Simon, John .. 2C L'pool
Snowdon, J. J. 1C W. Hrtpl
Summers, Geo. 2C Glasgow
Stalker, Alex... 2C Dundee
Stewart, Robert 1C Glasgow
Tarrant, Arthur 1C London
Wright, George 1C ,,

November 29th, 1890.

Allison, Robt., 2C London
Arthur, George 1C ,,
Barnes, H. A... 1C N.Shields
Bruce, Robert.. 2C London
Burnett, James 2C N.Shields
Carter, S. C. .. 2C ,,
Coughlan, T. C. 1C N.Shields
Coulson, ChrisA. 1C Hull
Crawford, Jn. D. 1C L'pool
Crosby, John T. 1C Bristol
Drewet, T. .. 2C Hull
Grainger, T. J. 1C London
Heath, George 1C ,,
Honeywill, C. K. 1C Hull
Huer, Arthur .. 2C L'pool
Jacklen, Athr. J. 2C Hull
Jacobson, Jhn. A. 2C N.Shields
Jones, John .. 2C L'pool
Kavill, E. T. .. 2C Hull
Linford, G. W. 1C London
Lloyd, Edward 2C N.Shields
May, William F. 2C ,,
Nixon, Edward 2C Sndrland
Seymour, J. .. 2C N.Shields
Smith, Chas. .. 1C S'land
Taylor, Arthur 1C ,,
Tod, William .. 2C L'pool
Walker, Charles 1C S'land
Watt, William .. 1C N.Shields

December 6th, 1890.

Blair, R... .. 2C Glasgow
Blair, R. W. .. 1C Liverpool
Brown, J. N... 2C ,,
Brown, R. P... 2C Leith
Brown, T. .. 2C Glasgow
Brown, W. J. 2C ,,
Brownlie, Wm. 2C ,,
Chandler, Wm. 2C London
Crighton, Jas. 2C Leith
Davidson, Alf. 2C Glasgow
Davies, D. .. 1C Cardiff
Diamond, Wm, 2C Glasgow
Dixon, Paul .. 2C N. Shields
Duffy, T. .. 2C Liverpool
Edwards, Owen 2C ,,
Edwards, T. A. 1C Cardiff
Fox, A. D. .. 2C London
George, Jno. .. 1C Cardiff
Hamilton, Jos. 2C Glasgow
Heke, Thomas 1C Cardiff
Ingram, Alfred 1C London
Jackson, C. .. 2C Glasgow
Jarrett, Wm. G. 1C London
Johnson, E. T. 1C Leith
Laird, Henry J. 1C Cardiff
Leitch, Alex... 1C Glasgow
McCullongh, R. 1C London
Meager, W. C. 1C Cardiff
Mitchell, Jas... 1C Leith
Oswald, James 2C Cardiff
Parkinson, F. W. 2C London
Parry, F. T. .. 1C Liverpool
Patrick, Alex. 2C Glasgow
Phillips, W. H. 2C London
Pirrie, N. .. 2C Liverpool
Rees, John .. 1C Cardiff
Reid, David .. 2C Glasgow
Reid, W. H. .. 2C Liverpool
Rodger, Geo. W. 1C Glasgow
Rowe, Thos. .. 1C Cardiff
Smith, Chas. .. 2C ,,
Stephens, J. W. T. 1C ,,
Stringer, Alf... 1C ,,
Swedburg, C. E. 1C N. Shields
Wain, Thos. .. 1C Glasgow
Weir, Wm. J. 1C Dublin
Whelan, Edwd. 2C Liverpool
Wighton, Mat. 1C Leith
Young, Thos... 2C Glasgow
Zammit, A. .. 2C London

December 13th, 1890.

Barr, John .... 1C Greenock
Bishop, Thos.... 1C ,,
Brodie, N. C. .. 2C ,,
Buchanan, D... 1C Hull
Burt, Robert .. 2C Greenock
Corsane, Jas. H. 2C Dundee
Crombie, Jas. .. 2C Greenock
Findlay, Lewis. 1C London
Fitzmourice, C. H 1C L'pool
Fleming, Alex.. 1C Greenock
Harrold, Foster 1C N.Shields
Hickie, Thos. .. 2C L'pool
Holden, Jas. A. 2C Hull
Hunter, Arch .. 1C Greenock
Hyndman, H... 1C ,,
Irvine, William 1C Dundee
Jeffery, Wm. R 2C Hull
Ruinear, Thos., 2C Greenock
Lawson, M .... 2C N Shields
Lister, Hugh .. 2C Dundee
Liston, John .. 2C London
Mathias, Wm.. 2C L'pool
Mannix, P. .... 2C ,,
Marshall, Wm. F 1C London
McFadyen, D .. 2C Greenock
Mitchell, S. .... 1C London
Morrison, Wm.. 1C Greenock
Munn, Robert.. 1C ,,
Paterson, Alex. 2C Dundee
Pocklington, A. 1C Hull
Scott, John .... 2C London
Sealy, Charles.. 2C Greenock
Sparks, W B. 1C L'pool
Wallace, James.. 2C Dunde

New Stevedore Company.—The prospectus has been issued of a new company called "The Tyne Co-operative Stevedore Co., Limited," the object of which is to undertake the loading and discharging of vessels on terms which, it is claimed, will be specially advantageous to shipowners. The share capital is to be £5,000, and will consist of 1,000 preference shares and 4,000 ordinary shares of £1 each. As the name implies, the business of the company is to be conducted on the co-operative principle, and, as it is quite a new departure, the circumstance of its formation is regarded with unusual interest.

The Marine Engineer.

LONDON, FEBRUARY 1, 1891.

IT may be well in the opening of the New Year to review what has been done in the interesting field of forced draught, and the effect it has apparently had upon increased devaporation and possibly greater economy in fuel. In the face of much criticism Mr. Howden has stuck manfully to working out this problem, and appears to have effected a great deal of valuable consolidation in the practical success of his operations. This firm, and other firms working under licence from him, have, we understand, during the past year applied his system of forced draught to more than 50 steamers, making a total of over 125,000 I.H.P. fitted or in progress during 1890. This is good work, and must be taken to prove that he has now solid ground and experience in all the latest precautions and arrangements necessary to effect a successful issue. It is worthy of remark that in spite of many troubles occurring here and there, and particularly in the Navy, in the leaking of boilers, pressed with forced draught, Mr. Howden's system seems to be very free from such complaints, and we think that this has been largely due to the fact that he does not use any very excessive air pressures, but depends for economy upon the employment of high initial pressure of steam, such as that of 160 lbs. per square inch, and triple-expansion engines. We believe his air pressure in the ashpit seldom exceeds that due to 1 inch of water, and the combustion effected per square foot of grate area is not more than 28 to 30 lbs. of fuel per hour. As a matter of uniformity of temperature and draught, there is little doubt that an artificially produced draught by a fan or blower is much more reliable than from the natural draught; for with even the best arrangement of wind sails, the supply of air to stokeholds, as is known to every seagoing engineer, is very irregular, and differs much when the wind is aft or right ahead. Mr. Howden's arrangement consists of a series of tubes fitted in the base of the chimney or in the top of the up-take. The cold air supplied by the fans is raised to about a temperature of 150 deg. by passing around these tubes, through which the smoke passes, and the heated air is divided between the closed ashpit and the furnace, about two-thirds going into the ashpit and one-third above the fire. Mr. Howden makes a point that valves may be closed by opening the fire doors, so as to shut off the forced draught, when the fire has to be stoked, though it does not seem that much danger of accident has arisen in practice even where the blast is not shut off. The results now accessible of the re-fitting of ocean-going steamers with triple-expansion engines and forced draught, in comparison with the old-fashioned compound engines and natural draught, are most impressive, and again bring the merits and ingenuity of our private engineering and shipbuilding firms in startling comparison with the failures in the same direction which have so frequently occurred in the Navy. For example, the *Sarmatian* had originally 10 single-ended boilers with 20 furnaces occupying 124 ft. over engine, boiler, and bunker space; she has now two boilers and six furnaces, occupying, with engines and bunkers, only 59 ft. 6 in.; the same H.P. as before being indicated with about half the fuel, and an increase of some 1,900 tons of cargo being also gained to the good. The *Peruvian* had originally eight boilers and 16 furnaces; she has been re-fitted with two boilers and six furnaces, with forced draught and improved engines, and now indicates, with half the consumption of coal, an equal power to that formerly obtained from the eight boilers, with a saving of space for further cargo. In the *Aleppo* there were two double-ended boilers, with six furnaces each, or 12 in all, and they have now been replaced with two single-ended boilers fitted with two furnaces each, or four in all. Forced draught has been applied and triple-expansion engines, and the consumption of fuel is little more than half what it formerly was for the development of considerably more I.H.P. The *Indiana* has been converted from a first-class passenger ship into one for cargo purposes, with reduction of about one-third H.P. Her boilers were a originally three double-ended boilers having six furnaces each, or 18 in all. They have been successfully replaced by one boiler with forced draught, having three furnaces, the saving of space for extra cargo being very large indeed. There is thus little doubt that the old compound engines with comparatively low initial pressure of only some 50 or 60 lbs. per square inch, and large low-pressure boilers, with natural draught and enormous volume, are thus now commercially obsolete, as their running expenses will kill them in comparison with the latest improvements, as the above examples show. There is no doubt that the higher initial working pressures and greater rates of expansion in triple-expansion engines must be credited with the major portion of the above economy of fuel lately effected, but to the credit of the aforesaid forced draught must be placed a greatly increased and more regular and reliable evaporation, whereby the weight and size of the boilers is enormously reduced for the production of a given weight of steam evaporation. We should be glad if our sea-going readers would afford us as much information as possible of their experience with forced-draught boilers, as it is a subject of particular interest and has been much debated and questioned, and now seems steadily to be making ground in the commercial marine, which is usually the best and truest test of commercial success.

ONE of the main objects of the Canadian Pacific Railway is to provide a much faster route to Japan and China from the United Kingdom than any existing, while another leading purpose of the route is to secure more rapid passages between this country and India and Australia than *viâ* the Cape if the Suez Canal should be blocked, and faster transits also between Great Britain and Australia than *viâ* the Canal. Now according to a contract between the Postmaster-General, the Commissioners of the Admiralty and the Canadian Pacific Railway Co. for the conveyance of mails, troops, and stores between Halifax and Quebec and Hong Kong, the Company arranged for a subsidy of £60,000 a year for ten years (£15,000 of which sum is to be paid by the Dominion Government) to provide a monthly mail service between Halifax or Quebec, according to the season, and Hong Kong, the steamers between this last-named port and Vancouver to call at Shanghai and Yokohama, and to carry mails and passengers to and from these ports. It was stipulated that these liners were to run not less than 17½ knots an hour on the measured mile, and not less than 16 knots an hour on sea trial, which was to be of 12 hours duration at the least. It was further provided that these steamers were to be constructed according to Admiralty requirements, so that they might be suitable for cruisers or transports. The Naval Construction and Armaments Co., Limited, of Barrow, have acquitted themselves remarkably well in the building of these splendid boats, which will soon be all running on the new routes arranged for them. Their speed will, it is stated, be rather higher than that contracted for. Satisfactory assurances were given a considerable time ago by the Dominion to the Imperial Government that when one or more of the new steamers of the Canadian Pacific Railway Co. were ready for sea, an arrangement would be made to secure, an accelerated steamship service on the Atlantic in connection with them. It is stated that Mr. Bryce Douglas, Managing Director of the Naval Construction and Armaments Co. has secured the subsidy from the Dominion Government for the first Atlantic line, which will require four large 20-knot twin-screw steamers. It is reported that the subsidy scheme includes a line of fast steamers between Vancouver and the Australian Colonies to touch at the Sandwich and Fiji Islands, and for which a separate subsidy has been voted by the Canadian Parliament. The representatives of the Australian Colonies have been recently asked to contribute to this subsidy, and negotiations are now pending on the subject. It is proposed that the steamers between Vancouver and Australia shall embark and land passengers and goods at Brisbane, which has now good railway communication with New South Wales and Victoria. If this new Pacific route to the Antipodes is run by or nearly as fast ocean liners as are arranged to be run on the Atlantic in connection with the Canadian Pacific Railway, there is every reason to believe that mails, passengers, troops, and naval and military stores can be landed in Australia in 22 or 23 days, from Liverpool or Milford, and possibly sooner than this, if the Canadian Pacific Railway Co. run express trains, as it could, from the Atlantic to the Pacific, in from 75 to 80 hours. Indeed, we feel convinced that before the end of the century passengers from Brisbane can be landed in England in three weeks and *vice versâ*. If they are, their transit between Great Britain and the Antipodes will then be accomplished several days before it can be through Suez *viâ* Brindisi.

THE year 1890 has been a busy one for the manufacturers of machine-tools employed in shipyards and engine shops. The demand has not only been for machines of ordinary calibre to augment the existing plant of given firms, but it has also taken the form, in quite a striking degree, of a desire—nay, an imperative necessity—for machines of greatly increased power and efficiency. Much of the demand for such machinery, during the past year, has doubtless been caused by the specially heavy character of the ships which have been placed during the years 1889 and 1890; but there is another obvious and more noteworthy cause to account for it. The possibilities which attach to the use of Siemens-Martin mild steel, in the way of manipulating the heavier plates in a cold state, are now better understood, and this alone has opened up a field and prospect for the shipbuilder and boiler-maker which were scarcely even dreamed of some years ago. The exigencies of the high-pressure now carried in marine boilers, and the necessity for more thorough and accurate fitting and careful manipulation of the parts of marine engines, have also operated to increase both the number and the capacity of the machine-tools used in marine engineering establishments. Hydraulic power seems to be the kind best adapted for use in the machines taxed with greater duty than previously; and the several manufacturers of hydraulic machine-tools, during the year have had great demands, not only on their industry, but on their inventive skill as well. Amongst notable modern types of machine-tools, one or two we may refer to *e.g.*, huge plate-flanging or bending machines—one of which, now at work in the Fairfield shipyard, can operate upon plates 32 ft. in length and up to 1¼ in. thick; large vertical plate rolls capable of rolling boiler plates cold, up to 1½ in. thick; exceptionally powerful stationary hydraulic boiler riveters; heavy and lengthy ship-plate rolls; and portable hydraulic tools of greater handiness and efficiency than previously. The remarkable, and still improvable, facility with which heavy steel plates are now bent and flanged would seem to render possible the building of ships of flanged plates alone, in place of with angle frames and keelsons. This is the subject of a patent system about to be worked by a limited company. The proposed method consists in building ships out of plates, flanged on all four sides by hydraulic power, except in ships of larger size, in which web frames may be required, the substitutes for web frames and keelsons are to be the flanges of the plates, which are to be punched and riveted together by movable hydraulic tools of light and handy construction. The system of substituting flanged plates alone for the usual combination of plates and angles is already largely employed in some shipyards for certain of the internal features in ships, and its extension to meet the case of the main shell is certainly a feasible notion. If the requisite strength and rigidity can be secured, at the same time that weight of material is saved throughout the whole structure, there will be no question as to the success of the system. The saving in labour, according to the inventor, is the notable feature of the system, as it admits of the simultaneous punching of two plates being done by one man and a boy. Should this scheme be successfully carried out, the makers of hydraulic machine-tools may be expected to still further benefit from the demand for improved machinery; and should it only be a partial success, after fair trial, the experience gained will at least be useful to shipbuilders and machine-tool makers alike.

THE importance of the engineering complement in the war ships of the Navy is becoming more and more a subject of great importance, and Lord George Hamilton's words may be quoted where he says:—"It is necessary for us to endeavour to establish in the Royal Navy such a system of training and education as will give both officers and men adequate knowledge of the duties they are called upon to perform." There is no doubt that the training of the military branches of the Royal Navy, including officers, warrant officers, seamen, gunners, torpedomen, marines, and marine artillerymen, has been got up to a most complete system, but unfortunately the engineering department, chiefly as represented by stokers, who are a most important part of the engine-room complement, go to sea without any training at all worth mentioning. In warfare it is quite possible that a knot or so in speed might make all the difference in capturing or being captured, and Capt. Noble, of Lord Armstrong's firm, last year said, "In future naval battles the weather gauge will belong to the fastest ship and the best engine-room complement." Chief Engineer J. Langmaid, R.N., has been reading an interesting paper upon this subject, entitled "A proposed method of training Naval Stokers and otherwise increasing the efficiency of the Steam Branch *personnel*" before the United Service Institute. Mr. Langmaid concluded that at least 600 stokers must be recruited annually, and under present circumstances would be sent to sea with no training in engine-room duties. In modern ships of the cruiser type the stoker complement is almost as numerous as that of the blue-jackets, and their services, perhaps, more important as regards success in warfare. The second-class stokers do not seem to have much chance of training, since, whenever there is any difficulty in getting or keeping up steam, the second-class stokers are at once taken off the fires and the good firemen put on. Although stokers are put through a company and small arms drill on joining the service, this is evidently of little advantage to them in their engine-room capacity. As a solution of the difficulty, Mr. Langmaid proposed that all newly-entered men should be sent to a central training vessel in the same way that Royal Marine recruits are sent to the depot at Walmer, and should be trained there for three months, this course to be followed by three months' sea experience in a modern cruiser. At the end of six months they might, if qualified, be rated stokers, and sent to seagoing ships. It is suggested that the *Marlborough*, tender to H.M.S. *Asia* at Portsmouth, would suit admirably for a harbour training-ship. It is proposed that the course of instruction for stokers should include:—1. The names and uses of principal parts of boilers and engines. 2. The duty of a stoker in managing fires. 3. In knotting and splicing. 4. Boat exercise, rowing, etc. 5. Drill, cutlass and rifle exercises. 6. Gymnastics. 7. Miscellaneous duties of stokers. The teaching staff, it is thought, need not be large, one senior and one junior engineer officer, with two, three, or four good leading stokers, would probably be sufficient for the technical subjects, with one warrant officer and a few petty officers for the nautical subjects. In the case of sudden outbreak of war, there would no doubt be a large number of cruisers suddenly commissioned, and it would be of the utmost importance that the engine-room complement should have had efficient experience before joining. It has been suggested that seamen might be taught stokers' work, so that they might be interchangeable for duty on deck or below; but it is open to doubt whether good stokers would result from this practice. It is probably only seagoing engineers who are fully aware as to what a difference is to be obtained from marine boilers in the hands of good or inexperienced stokers. Other gentlemen present, including Mr. R. W. Edwards, Chief Engineer, R.N., Admiral Cleveland, Admiral Colomb, and others concurred in the importance of ensuring good practical training to stokers in their own special duties, and one of the speakers went so far as to say that the artificers were of little use on board ship until after the first year's experience, as their training on land had been but of a special character. It is well that attention should be paid to the fact that if skilled stokers are of advantage to the Navy as is now generally recognized, they should have every inducement offered to them for re-engagement after many years experience. It has been said that stokers as a class are somewhat discontented, for while they are made to do the work of the blue-jackets they are not treated like them with regard to pay, and the result is that after their 10 years' service they did not re-engage. It stands to reason amongst those who know the effect of efficient stoking upon boiler evaporation that such skilled men are well worth 3d. per day extra. It is also a bad practice to take the pick of the stokers away from their engine-room duties to place them in charge of the electric light, torpedo, and other fittings in different parts of the ship, so that practically none but the worst and ill-trained men are left in the engine-room to keep the ship going when at quarters, or in any other emergency. It is extremely probable that the cost of the preliminary training of stokers before any regular engagement at sea would be amply recovered by the saving which could be effected in coal consumption by their better practice in, and understanding of, the stoking and managing of the boiler.

INSTITUTE OF MARINE ENGINEERS.

A MEETING of the Institute was held in the Langthorne Rooms, Stratford, presided over by Mr. F. W. Wymer (Vice-President), on Tuesday evening, 13th January, when a paper was read on "Capital and Labour" by Mr. F. W. Shorey.

The Chairman introduced the author of the paper, pointing out that although much had been said and written on the subject, the solution of the difficulty called for more, and if any light could be thrown on the question of how to deal with the troubles which arise from time to time in connection with capital and labour, the paper would prove of great value to the community at large.

The paper dealt first with the origin of wealth, the source of the latter being set down as the materials held by mother earth until won from her hand by the skill and labour of man. Granting the materials to be at hand, the labourer is necessary for moulding them into shape for the purpose of commerce. The value of the products of work differ according to the facilities at command in the various countries for disposing of such products, while climate and national differences in respect to food, clothing, and other necessaries of life tend to regulate the cost of production; and, it may be added, the mental and physical calibre of the workers also affects the cost, and more especially the true value of the product, the true value being often however lost sight of in view of a certain fictitious value placed upon it for one reason or other. Reference was made to the recent strikes in London and the losses involved to the community as a whole and to the labourer in particular. Several of the remarks made by Cardinal Manning in connection with the "Dock Strike" were quoted and commented upon, and it was questioned if any gain had accrued either to the country or those concerned by the strike A fever had been raised which had spread far and near, and had been the means of hindering not only the products but the means of production.

A scheme of profit-sharing was proposed under which the superior man would, in his own interest, do his utmost to work faithfully and well himself and see that his neighbour did not misspend his time, while a percentage of the net profits should be devoted to a fund for pensioning off old servants.

The words of Sir H. Parkes, spoken in the House of Assembly at Sydney in October, 1890, were quoted, in which he said that the strike there was almost as disastrous as a bombardment, adding, "the country would suffer less at the hands of an enemy."

On the conclusion of the paper the discussion which ensued was exceedingly animated and interesting, and was sustained by Messrs. L. P. Coubró, J. McF. Gray, A. W. Robertson, G. Wiltshire, and others.

In the course of the discussion an allegory was drawn from well known characters in early history, and it was very impressively urged that far too much had been made of the labourer and his hire in very many cases by agitators whose capital consisted of the discontent they could ferment amongst classes of workers of all kinds It was pointed out that an increased rate of wages to one class of workers involved, as a rule, higher prices for many of the necessaries of life, not only to those whose wages are thus raised, but to those whose wages remain as before; the effect is thus to increase the poverty of the latter without really enriching the former to any extent. It was also urged that the principles of social economy were seldom understood by those who professed to teach the labouring classes, and that if the Book of Wisdom and its precepts were better understood and followed much of the gratuitous advice given to the people would be withheld. It was further remarked that the wealth of a nation consists in the wisdom of its rulers; that the labour element forms but a fraction of the wealth-producing power. The brain of Nasmyth, which planned the steam hammer and gave it to the nation, had been more powerful than many scores of labourers, therefore it was meet that the brain and skill which directs the capital and gives employment to the labourers should be left as free and unfettered as possible. Faith in those who have made the capital and wealth of the nation what it is, becomes not only the duty but the privilege of those who are dependent upon the brains to plan and the skill to execute enterprises of which the majority are incapable. The possibilities of rising by brain power from the lowest to the highest dignities are within reach of all; the son of a peasant may become the friend of a prince, and those who have the talent to rise should not be grudged the elevation and be looked upon as those who have, like Cain, smitten their brother to the death.

The proceedings were brought to a close by votes of thanks to the author of the paper and the chairman, which were duly responded to, and it was further resolved that the discussion should be continued.

THE SCISÉOPHONE.

AN instrument for detecting flaws in metal castings and forgings, which is called the sciséophone, has been invented by Captain de Place, of Paris. The apparatus consists of a small pneumatic tapper worked by the hand, and with which the piece of steel or iron to be tested is tapped all over. Connected with the tapper is a telephone with a microphone interposed in the circuit. Two operators are required, one to apply the tapper and the other to listen through the telephone to the sounds produced. These operators are in separate apartments, so that the direct sounds of the taps may not disturb the listener, whose province it is to detect flaws. The two, however, are in electrical communication, so that the instant the listener hears a false sound he can signal to his colleague to mark the metal at the point of the last tap. In practice the listener sits with the telephone to his ear, and so long as the taps are normal he does nothing. Directly a false sound—which is very distinct from the normal sound—is heard, he at once signals for the spot to be marked. By this means he is able not only to detect a flaw, but to localize it. Under the auspices of the South-Eastern Railway Co., a demonstration of the sciseophone was given recently by Captain de Place, at the Charing Cross Hotel, in the presence of several members of the Ordnance Committee and other Government officials. Among those present were Sir Frederick Bramwell, Sir Benjamin Baker, General Hay, Colonel Watkin, R.A., Colonel Bainbridge, R.A., Colonel the Hon. Reginald Talbot, Captain Domvile, R.A., Colonel Surtees, Captain Bridge, R.N., Dr. William Anderson, Sir Edward Watkin, Sir Myles Fenton, Captain H. F. Gye, R.N., Mr. Stirling, C.E., Mr. Brady, and Mr. Wainwright. Mr. Stirling, the company's locomotive superintendent, had previously had several samples of steel, wrought iron, and cast iron prepared with hidden flaws known only to himself. The first sample tested by Captain de Place he pronounced to be bad metal throughout, which Mr. Stirling stated he knew it to be. Other samples were tested, and the flaws localized by means of the apparatus. On breaking some of the bars of wrought and cast iron the internal flaws—the localities of which were known to Mr. Stirling by his private mark—were found to have been correctly localized by Captain de Place. On the other hand, it has to be stated that some bars were broken at points where the apparatus indicated a flaw, but where the metal proved to be perfectly sound. Making every allowance for the experiment being conducted with occasional interruptions from the visitors, it shows that, however ingenious the invention, it can hardly yet be called a practical success. Having, however, accomplished so much, there is every reason to suppose Captain de Place will succeed in rendering the apparatus perfectly reliable.

THE HULL AND DISTRICT INSTITUTION OF ENGINEERS AND NAVAL ARCHITECTS.

THE members of the Hull and District Institution of Engineers and Naval Architects held their third general meeting of the sixth session on Tuesday evening, January 13th, 1891, in their Rooms, Parochial Office, Bond Street, Hull, when a paper on "Art in relation to Shipbuilding" was read by Mr. F. Somerscales (Earle's Shipbuilding and Engineering Co.)

The author commenced his paper by pointing out that all fine arts depended primarily on the true apprciation of the beautiful, and that the external form and structural details of ships (like all other constructive work) afforded ample opportunities for displaying this appreciation just as well as in the saloon decorations.

The cabin decorations were also referred to and compared with ancient ship decorations, and in continuation of his subject the author urged that a general appreciation and delight in material beauty was better exemplified by the way in which common objects of utility were shaped, proportioned, and ornamented, than in a lavish outlay on special decorations placed side by side with ugliness and plainness in these everyday surroundings.

The various points of the paper were well illustrated by diagrams and blackboard sketches, and samples were given of different parts of a ship where the opportunity was afforded for manifesting an interest in art, amongst others being the lower portion of the stern frame—the stem—the break of the poop—the "run" of the forward plating, where it meets the stem, the position and relative proportions of the masts and rigging, and of the funnel.

In the discussion which followed the following members took part:—Messrs. G. J. Cole, F. H. Pearson, J. Spear, M. Allen, C. F. Amos, J. R. Smith, J. Jamieson, and A. Young.

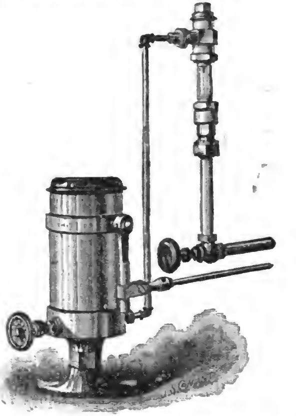
The meeting terminated after a cordial vote of thanks had been accorded to Mr. Somerscales for his valuable and interesting paper

THE HARLOW MECHANICAL SIGHT FEED LUBRICATOR.

THIS lubricator is the patent and manufacture of the Harlow Lubricator Co., U.S.A., and seems to offer some advantages over the hydrostatic sight feed lubricators now in use.

It has a perfectly automatic action in relation to the running of the engine, delivering oil only when that is in motion, and requires no attention whatever from those in charge of the engine, either at the time of starting or stopping, as is the case with most lubricators on the sight feed principle.

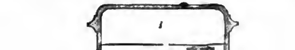
"The Harlow" may be described as a pump lubricator in contradistinction to the hydrostatic lubricator. In this latter it is almost impossible to maintain the feed at a constant rate, that is, if it be adjusted at one time for a certain number of drops per minute, the rate is not maintained, the tendency being to a decided falling off. The principal advantage claimed for the former is, that the feed is, and must be, positive and constant.



We give here a perspective and a sectional drawing of the Harlow, from which its working will be readily seen. In section, A is the feed regulator, B and C, a rack and pinion operating the plunger, D, an outlet valve, E plug and spring over outlet valve, F, strainer over suction chamber, G, gland, H, removable base, I, cap or cover, and U, suction port.

It seems to be unaffected by varying temperature or atmospheric changes, and can be used in the most exposed situations without the danger of freezing, as there is no water used in or about it, and on the other hand the temperature of the oil is never above that of the engine-room.

The oil is fed to the parts to be lubricated, in very small drops, from one drop per minute to a continuous stream, as may be required. This ensures the utmost economy of oil and a much more even lubrication than by those lubricators which give large drops at long intervals. The cup can be refilled with oil at any time, like an ordinary oil cup, without in any way interfering with the lubricator's action, by simply raising the cover and pouring in the oil. Chocking and clogging at the sight feed orifice is avoided, in fact rendered impossible by the pump action, which will force a passage should any temporary stoppage occur. There is no steam required, and leakage from steam pressure therefore cannot take place, and as there is nothing in its construction to wear out, after several years of constant use it does not seem to show any sign of wear in any of its parts. These are all made to gauges, so that if a part should get lost or broken by accident it is only necessary to send for a duplicate, with the certainty of its fitting.



Messrs. Green & Boulding, engineers, &c., 21, Featherstone Street, City Road, London, are the sole European agents for the company.

THE GERMAN SHIPPING TRADE.

THE progress of the German shipping trade, though not inconsiderable, nevertheless does not come up to the general development of German industry and commerce. On the 1st of January, 1890, the Merchant Fleet of the Empire comprised 3,594 sea-faring vessels, capable of loading 1,320,721 tons [illegible] against 4,257 ships with 1,294,288 tons capacity at the [illegible] 1885. During the quintennial period, the number [illegible] was reduced from 3,607 and 880,345 tons, to [illegible],810 tons net; whereas steamers rose from 650 [illegible]ns, to 815 and 617,911 tons net. The movement in favour of steamers against sailing vessels corresponds with the same tendency in all other countries, but this circumstance does not alter the broad fact that the greatly increased international sea-transport had very little effect on the German Merchant Fleet. The insignificant augmentation of the tonnage dates, moreover, only from the year 1889, as the figures of January 1st, 1889, were below those for January, 1885. It should, however, be taken into account, that steamers, capable of undertaking more journeys during the year than sailing ships, are consequently estimated at three times the carrying capacity of the latter; and, calculating the efficiency of the fleet on this basis, it is shown that it could load 2,122,174 tons net in 1885, and five years later 2,556,543 tons—a progress of 20½ per cent. In this addition the Baltic does not participate, as its tonnage power fell by nearly 10 per cent., whereas that of the North Sea rose to the extent of 34½ per cent. Hamburg's fleet was increased by 8·3 per cent. as to the number of ships, and by 40·8 per cent. in respect of their carrying capacity; but the Bremen fleet lost 6·6 per cent. in numbers, and gained only 9·9 per cent. in space. Of the 91 sailing and 86 steamships added in 1889, 77 of the former and 49 of the latter were built in German dockyards; whereas 14 sailing-vessels and 37 steamers came from abroad. The 37 steamers built in foreign countries were by far the most powerful ships, as they aggregated 67,242 registered tons, against 52,946 tons of the 49 constructed at home. The whole fleet undertook, in 1889, 55,934 journeys, and carried 21,398,522 tons, compared with 54,054 journeys and 15,434,820 tons in 1885. Of these journeys 11,503 and 12,331,752 tons were between German and foreign ports (1885, 10,118 journeys and 7,933,153 tons), and the remaining voyages between German ports only. The latter traffic, as well as that between German and European ports, was less remunerative than the service between German and non-European ports. The commercial community of the Fatherland is dissatisfied with this slow progress (particularly because other powers simultaneously developed their carrying trade on a far more extensive scale), and ascribes the comparative failure to the protective policy which prevents German foreign trade from expanding at a higher rate. The Hamburg Chamber of Commerce bitterly complains of the obstacles shipping had to battle with last year, firstly, the import duty on the necessaries of life, then the order prohibiting the importation of bacon, together with the threatened retaliation against the M'Kinley Bill, and other measures. The Chamber most urgently recommends the conclusion of new treaties of commerce, and, in accord with the Bremen authorities, points out that, whereas business was fairly satisfactory in the first half of 1890, the second half in many cases swallowed up the profits of the first. Over-speculation, strikes, the rise in the price of fuel, the American legislation, the frequent variations in the value of silver, and at last the Argentine crisis, are said to be in the main responsible for this condition of affairs. The leading companies, like the North German Lloyd, the Packet Steam, and others, are therefore expected to reduce their dividends for the current year by 2 to 3 per cent.

The most interesting feature of the complaints referred to is certainly that the foremost commercial bodies of Germany are now clamouring for Free Trade as the only salvation, whereas not long ago they were decidedly in favour of a protective policy *à outrance*.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

ON Wednesday evening, January 21st, at a meeting of the Civil and Mechanical Engineers' Society, held in the Westminster Palace Hotel, Mr. Robert Capper, A.I.C.E., read a paper on "The Engineer and his Workmen." Mr. R. Nelson Boyd presided.

Mr. Robert Capper said he would draw attention that evening to the so-called mysteries of trade unionism, to specimens of various remedies for it that had been suggested or were in force, and to Sir William Thomas Lewis's scheme, which *The Times* had described as an important one, for the settlement of labour difficulties in this country. In bygone times the hours of labour and wages were fixed by law, and combinations of workmen were illegal. The old trade guild was a union of all the men in a trade, masters and workers alike. It sought to promote the interests of all, and thus insured a neutrality of interest which did not exist now between employers and employed. The associations of workmen in trade unions at the present day were described as aggressive, defensive, and provident. Until quite lately he was under the impression that a vast majority of workmen were members of such bodies, but from the Blue-book returns, which were admittedly incomplete, this did not appear to be the fact. While the wage-earning part of the population was between five and six millions, the number of unionists did not exceed 600,000 at most. Though the total number of trade unions was over 300, a large majority of them had but a small membership, some being as low as 10. Many neither kept nor published complete records of their transactions; others objected entirely to supplying information as to their affairs, And well they might, inasmuch as one trade union of 56,000 members and an income of £28,000 had quite recently boasted that it had spent, and was spending, 22 per cent. more than it received. The demand for superannuation benefit had steadily increased, and it was possible for young members to obtain the control of unions and deprive their older brethren of the provision against sickness and decrepitude to which they had become entitled by, perhaps, 30 or 40 years' subscriptions. Most of the unions were reported to be excellently managed, but it was a fact that over 300 delegates, elderly men, who had attended trade congresses at one time and another, had adopted Sir William Lewis's scheme as their own. There was a generally prevailing idea that trade union funds were spent chiefly in fighting employers, and he had been astonished to find it officially stated that out of 39 of the principal trade union societies, with a total of 274,727 members, an aggregate of £33,729 had been expended in dispute-pay—a general average of 2s. 4½d. per member, which was a very small proportion indeed. The labour correspondent of the Board of Trade avowedly sympathized with the aims of trade unions. For this he could not be blamed from an employer's point of view, because the employers, as a class, had never given the workmen a choice of unions. Although trade unionism had made heavy drains upon the workman's pocket, it had advanced rapidly during the last year or two, and it was a question whether the time had not come for the engineer, as an employer, to brace himself up and offer the workman a choice between trade unions, a trade union with both engineers and workmen setting at the same table, or leave the workman the prey of a paralyzing influence. The majority of the strikes that had recently taken place were without any sort of justification, while agreements and stamps had been regarded as wastepaper. There was, however, a large amount of common-sense among the better class of workmen, as could be seen from the resistance offered to the advanced aggressive school at Congress. The remedies proposed in the matter were conciliation boards, profit-sharing schemes, and union of employers and workmen. Neither in London or elsewhere was the first system in order, owing to the supineness of employers. He thought that in the majority of settlements effected by boards of conciliation peace was only patched up. No one could tell when the secret conclave of a trade union would determine upon a strike. In reference to profit-sharing, it might be noted that the South Metropolitan Gas Co.'s nest-egg, with interest, last July amounted to close upon £7,000; the bonus last year was £5,821, of which sum £2,641 had been withdrawn. The union of employers and workmen was upon a trade basis, without risk to the latter. Both had equal voices in the matter; both contributed to the funds. It was not unreasonably intended, however, that employers who paid wages should continue the right to choose their own workmen, and the workmen, when chosen, were expected to obey orders. The scheme helped the workmen over the initial difficulty of beginning to put by a little money, and contained an embodiment of the principle on which the numerous miners' permanent relief funds had been founded and successfully worked. At Southampton a free labour association of employers and employed upon the lines laid down by Sir William Lewis had enrolled more than 1,000 members.

Mr. Boyd, after speaking of the importance and difficulty of the subject dealt with in the paper, said he thought that the tyranny of the workmen among themselves was not so great as that to which they were subjected by employers in the past. The trade unions had done much to improve the position of the working man. Strikes were to be deplored for the sake of both parties, but as a rule they had not been originated by the better sort of trade unions.

Other members joined in the discussion, and a vote of thanks to Mr. Capper brought the meeting to a close.

THE BRISTOL RECORDING PRESSURE GAUGE.

HIGH steam pressures and fast steaming being now the order of the day, any invention which will tend to increase economy by regulating the consumption of that most important factor in the equipment of steamers—coal, must be recognized as a direct benefit. With the best of engines on board and all the latest appliances for saving fuel at hand, neglect on some points which require the exercise of intelligence may fail to develop the full value of any economizing apparatus, and among the retarding elements may be reckoned the bad management of the boilers. Careless and wasteful firing, with its accompanying successive rise and fall of pressures, may vitiate all the benefits which would be otherwise derived, and hence a check upon the work of the fireman will tend to make complete the economy aimed at. For this purpose a recording steam gauge is now acknowledged to be an essential part of the equipment of the engine-room of all steamers, so that a continuous record of the work done in the stockhold may be constantly under the notice of the engineer in charge.

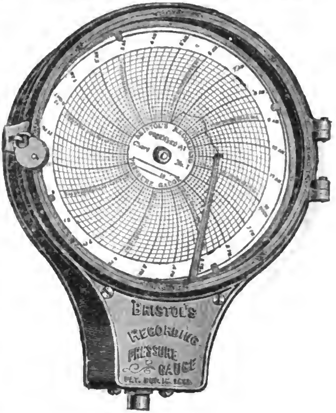


Fig. 1.

The pressure gauge under consideration is the invention of Professor W. H. Bristol, of the Stevens Institute of Technology, and. seems very ingenious and simple. Fig. 1 of our accompanying illustrations shows the instrument complete, and Fig. 2 shows the pressure tube with the inking pointer attached, the front of the case and the dial and cover of the clock being removed. As will be seen, the pressure tube A is of flattened cross-section and bent into approximately a sinusoidal form. A flexible strip B, of the same metal as the tube, is secured at the ends and along the bends

The bent tube may be considered as a series of Bourdon springs placed end to end. It is evident that pressure applied to the tube produces a tendency to straighten each bend, or collectively, to elongate the whole. This tendency to lengthen the tube is resisted by the flexible strip B, and is thereby converted into a multiplied lateral motion. The inking pointer is attached directly to the end of the pressure tube, as shown in Fig. 2, from which it will be seen that the usual mechanism and multiplying devices are dispensed with, since the motion of the tube itself is positive and of sufficient range. The special advantage of this is evident, considering that in the usual forms of pressure gauges the movement of the tube or diaphragm is small, and requires a somewhat complicated system of mechanism to multiply the motion many times before it is available for indicating purposes.

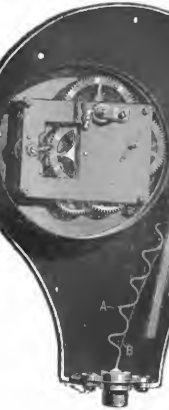


Fig. 2.

In the instrument illustrated, the tube is designed for a range of 180 pounds per square inch; for other ranges its sensitiveness may be varied at will by changing its proportions, as to length, shape of cross-section, or thickness. The printed charts for receiving the record make one revolution in 24 hours, and are provided with radial arcs and concentric circles, the divisions on the radial arcs corresponding to differences in pressure, while those on the concentric circles correspond to the hours of the day and night.

As the instrument is securely locked up, it is impossible for firemen or any unauthorized person to tamper with it. The record made by the gauge remains true, and any irregularity in firing can at once be detected, and unexpected and perhaps dangerous pressure can at once be known and precautions taken accordingly. Its use also ought to be invaluable in trial trips, as we fancy it is pretty well known that the ordinary gauges can be so manipulated as to record somewhat misleading pressures.

The instrument we have described is manufactured by the Bristol's Manufacturing Co., of Waterbury, Conn., U.S.A., and the agent for this country is Mr. J. W. Phillips, engineer, 23, College Hill, London, E.C.

STEAM FREIGHTS IN 1890.

MESSRS. ANGIER BROS., in their "Steam Freights for 1890," says:—The salient fact brought out by a review of the past year's steam shipowning is the sudden relapse of all freights and values of steam property from the high points reached in 1890 to about the lowest figures touched during the long depression in this trade from 1883 to 1887. The decline commenced with early spring, and continued rapidly till at the close of 1890 freights had reached as low figures as can be remembered, and the position is aggravated by the abnormally high cost of coal, wages, and all working expenses. The rates now ruling leave a heavy loss in working for all but cheaply-bought new steamers. Taking the fact that the increase of tonnage during 1887 to 1890 inclusive, largely exceeds that produced during 1881 to 1883, and that four years' severe depression was the result of the 1881 to 1883 over-production, it is but prudent to prepare for a similar lengthened depression for the future, more especially as trade generally is on the descending side of the cycle. This view must be taken as the guide for future operations to ensure anything like safety, and the only sure means of altering and improving the position is a wholesale laying up of steamers in order to reduce the amount of trading tonnage by some 25 per cent. of that now seeking employment. The loss of earning power has reduced the market value of steamers, and few buyers who know much of the working of them would be tempted to pay above £6 10s. to £7 for good new boats, with triple-expansion engines of the best type, and from 9 to 10 knots speed. Builders' costs, on the other hand, have not yet come down sufficiently to allow them to tender at these prices, but, all things taken into account, they run little risk by taking distant deliveries on about these terms. Referring to the different trades, America (United States), River Plate, and Black Sea afforded the chief support to the great cargo-carrying fleets, only falling off towards late autumn. India and China gave but a restricted and poor employment all through the year. Mediterranean and Baltic earnings have been poor all through from early spring to the close. Outward employment fell away in a marked degree, and kept at unusually low rates all through the year, the only exception being a short spurt in sugar and other exports to the United States from United Kingdom and Continental ports during the autumn, caused by the new tariffs fixed by the M'Kinley bill after certain dates. Labour troubles have harassed shipping as much or more than any interest. The unbearable tyranny and interference of the unions, and the systematic neglect of duty on the part of the Government in withholding the proper protection to free labour, forced into existence the "Shipping Federation," as the only means of successfully preserving liberty and independence of the unions to shipowners. The immediate success of this federation, with its great resources, has forcibly proved what power the shipping interest can wield by holding together. Government interference with shipping has resulted in two or three fresh Acts of Parliament—of which the Load-Line Act a useful measure productive of good, and the Life-Saving Appliances Act, worth little or nothing for its object and a harassing tax on owners, are the principal.

STEAMSHIP COMMUNICATION BETWEEN ENGLAND AND CHICAGO.—According to a New York correspondent a London Syndicate has revived the idea of establishing a line of steamships between England and Chigago, *via* the Canadian lakes. It is said that the canals, which are now navigable, render the project feasible, and that the agent of the syndicate is now making contracts. The capital stock is stated to be 5,000,000 dols.

OIL FUEL FOR WAR SHIPS.

WRITING from Her Majesty's ship *Rodney* during the Naval Manœuvres of 1888, our special correspondent predicted a general use of petroleum, either in the crude or the refuse form, as the fuel in the future for ships of war. The recent address of Mr. Nelson Boyd to the Civil and Mechanical Engineers' Society appears to have drawn a good deal of attention to the subject, and we understand that the matter is again being taken up warmly. It is clear that, as Mr. Boyd pointed out, ships could not use oil unless tank depots were established at nearly every port. But there is no doubt such depots would soon be established if ships were in any number fitted to burn the oil. So, for the present, progress is stopped because there are no ships to burn the oil, and because there are no depots at which the oil can be stored. It is now said to be probable that the first practical step will be taken by the Government. There are many reasons why oil should take the place of coal in war vessels. Its consumption can be so regulated that no dark vapour need escape so as to show the ship's whereabouts. Even the best Welsh coal leaves some trace in the air—in the language of Sir Walter Scott, "spreads its long dusky pennon through the clear ether." But the vapour from the consumption of the commonest petroleum refuse is invisible at the distance of a few hundred yards or less, if properly treated. The advantage of this invisibility to ships manœuvring against one another need not be enlarged upon. But there is a greater advantage to be obtained. The opprobrium of men-of-war of all nations is their limited capacity for stowing fuel. Now a ton of oil will lie closer in a tank than a ton of coal in bunkers. Its theoretical value is about three times as great; but let us say twice as great. So one ton of oil will do the work of two tons of coal. Therefore, if oil were substituted for coal our vessels would have at least twice the steaming endurance for the same stowage capacity that now obtains. Price for price, crude oil is dearer than coal by about three to one, but there is no need to use crude oil. In Russia the residuum, after distilling the illuminating oil and separating the lubricating oil, is found quite good enough. This need not cost so much as coal. We understand this residuum can be obtained for less than half the cost of coal, or indeed very little more than the cost of carriage. It could be pumped into railway trucks or tank steamers, then repumped into tanks well protected by earthworks, behind fortifications, whence it could reach the holds of the vessels using it either by pumping or by gravitation. Oil is to be found in nearly every quarter of the world, so that on many stations it could be delivered more cheaply than coal. It exists not only at Baku, where it has been known from prehistoric times, but in Hanover, where the trade is highly promising; in Galicia, where it has taken a great start, due rather to British than to Austrian enterprise; near Cette, in the Department of the Herault, in France; in Italy, near the line of railway between Parma and Modena; in Pennsylvania, Virginia, Kentucky, Ohio, and other parts of the United States; in vast quantities in Canada; in India, Beluchistan, Burmah, Persia, Peru, Mexico, Venezuela, the Argentine Republic, and in St. Domingo Mr. Boyd himself discovered it. There is not, therefore, any probability of the supply running short.

But, let it be also observed, the cost of altering our ships to burn petroleum, raw or residual, would be very little. Indeed, it is not going too far to say that both coal and oil could be burnt under the same boilers with no greater change in the furnaces than could be effected in an hour by an ordinary gang of stokers. And if oil were used instead of coal we should not need nearly so many stokers as we do now, when the Admiralty is, even in time of peace, at its wits' end where to find enough of this at present indispensable class; for the supply of fuel would be nearly automatic, and wholly within the control of one man at a time for each set of boilers, so that the engineer on duty could have everything under his own eye. It is mooted in naval circles that the experiments made some time ago in this direction by Admiral Selwyn are about to be resumed, at the charge and under the direction of the Admiralty. There is talk of giving up an old gunboat for the purpose, but in this, as in other respects, delays are dangerous. We are spending a great deal of money in protecting coal depôts in various parts of the world, and if we are not careful we shall have them completed just in time to pull them to pieces for the purpose of reconstructing them to protect or contain petroleum tanks.

Strange as it may seem, petroleum on board ship, in properly constructed tanks, would be much safer than coal, for it would not be liable to spontaneous combustion, and it would lie lower in the vessel, being thus far below the line of fire of an enemy, so that it would act as stable ballast. Then the neatness of our ships might be restored. At present the work of cleaning is twice as great as it used to be in the days of sails. This involves waste and cost of time that could well be spent in more remunerative ways than holystoning decks and scrubbing gratings. With petroleum, engineers are confident there would be no blacks, or next to none, to vex the heart of the commander or first lieutenant, and to keep half the ship's company engaged for hours every day. Nothing would appear out of the funnels, which might not even be done away with, and the vapour led away under the counter or the stern, thus removing one eyesore and a serious danger in action. It would be a strange thing if we reached the era of smokeless furnaces before attaining that of smokeless powder. And as it seems to be the received opinion that petroleum is the result of the decomposition of untold quantities of fishes swallowed up in some old-world convulsions, there would be a certain fitness in using it to plough the main withal. Upon the whole, there is reason to look forward to a speedy change in the use of fuel afloat. It may not be good news for our miners or mineowners, but it is doubtful whether for many a day to come the use of coal would not be prevalent in merchant vessels. On the great routes of the world, however, petroleum will replace coal before many years, and in the navies of the world it will probably be common before the century attains its end.—*Daily Chronicle.*

THE LIGHTING OF THE RED SEA.

THE Calcutta *Statesman*, discussing the increase in the number of accidents amongst vessels navigating the Red Sea, says that since the wreck of the *Dacca* attention has again been directed to the lighting of the Red Sea, especially at its southern end, where, it is said, the lights are insufficient. The reproach does not apply to the Gulf of Suez or the northern end of the Red Sea. The lighthouses of Suez, Zafarana, Ras-Gharil, and Ashrafi, in the Gulf of Suez, together with that of Shadwan Island, and further on the Brothers and the Daedalus appear, for the present, at all events, to be considered sufficient by shipmasters who follow the track recommended by the Admiralty. With regard to the southern end of the Red Sea, however, the case is different. Taking the sailing directions of the Admiralty as a basis, and also the experience of the masters of mail steamers and cargo boats, there would be no difficulty in selecting the sites where additional lights should be placed, and where they would be most useful. All steamships coming from the north end of the Red Sea and passing the Daedalus light shape a course for Jeb-el-Tier Island, a distance of 656 miles. Long practice has made it a rule in Red Sea navigation to make for certain points and as frequently as possible. The atmosphere, however, is very often hazy, with sand or dust, and Jeb-el-Tier, although a high rock, is thus obscured on these occasions. Here, then, it is considered, would be a fitting station for a lighthouse. After leaving this island, the Zebaiyer group, 600 ft. high, can easily be cleared on the port side, and a course shaped for the Abu-Ail canal, where, on Pile Island, a light should also be placed. Thence it is customary to steer a course to within eight miles from Moska, where a light could be erected. This would insure a safe course for Perim. These three suggested lights would benefit homeward as well as outward bound vessels. The perils attendant on the navigation of the southern end of the Red Sea are demonstrated by the numerous wrecks on its rocky and forbidden shores. The cost of establishing the lighthouses could be defrayed *pro rata* by the maritime powers chiefly interested. Great Britain would, of course, be the first on the list, 80 per cent. of the tonnage using this highway being under the British flag. Germany and France would rank next. If proper representations were made by owners and underwriters, as in the instance of the Suez end, there is no doubt that the nations vitally interested would see to them being effected. Shipmasters have suggested that the three fixed lights at Suez should be altered to flash lights. This is in consequence of so many steamers having their electric search lights up. The array of lights is bewildering on approaching the anchorage, and a flash light would do away with the uncertainty. Time balls, it is also suggested, should be placed at Port Said, as well as Aden, and they should be dropped twice a day. When these improvements are carried out, the Red Sea route will be one of the safest known for navigation.

STEAM LIFEBOATS.

At a meeting of the Society of Arts on January 14th, Mr. J. F. Green read a paper on "Steam Lifeboats."

Professor Elgar, LL.D., presided, and in opening the meeting said it was hardly necessary to say anything to recommend Mr. Green to the meeting. He was well known as an active member of one of the oldest, if not the oldest, firms of shipbuilders in the country, and one of the most eminent. He was a sailor as well as a shipbuilder, and thoroughly understood the sea and its ways. He had devoted himself to the improvement of lifeboats with great ability and enthusiasm, and had succeeded in overcoming the many difficulties of producing a mechanically-propelled lifeboat to the satisfaction of those who had to use her at sea and who trusted their lives in her. The subject was one not only of great mechanical and scientific interest on account of the mode of propulsion adopted, but it was of vital importance from a humanitarian point of view, and everyone would sympathise with Mr. Green and with the National Lifeboat Institution for the endeavours they had made to obtain a lifeboat that would be more powerful and effective than the ordinary boat propelled by a lot of oars.

Mr. Green commenced by reminding his hearers that at the last meeting of the British Association at Leeds he had read a paper on the hydraulic steam lifeboat his firm were building for the Royal National Lifeboat Institution. Since then it had been completed and sent out on real lifeboat service, and therefore he was now in a position to supplement his former paper by giving actual proofs of the great value as a life-saving vessel of the first steam lifeboat ever constructed. The design contained many peculiarities, and the mode of propulsion was the water jet propeller. The hydraulic system had been adopted because no other method of propulsion would drive a similar vessel at the same speed in anything of a sea. The advantages claimed for the steamboat he had constructed, which, he asserted, had been fully proved by exhaustive trials, were as follows:—(1) The propelling power in the vessel is instantaneous, and as efficient in heavy seas as in smooth water. (2) No racing or injurious effects to the machinery, however much she rolls or pitches. (3) The vibration experienced is very much less than that met with in a screw or paddle-boat. (4) As the engine only runs in one direction, the complication, weight, and wear and tear of machinery is greatly reduced, and there is no loss of time, due to stopping and reversing, for going astern. (5) The management of the vessel is entirely in the hands of the officer on deck, who, by working two handles, fitted on the after end of the engine-casing, can thus control the jets, and "stop," "go-ahead," or "go-astern," without any communication with the engine room. (6) There are no serious obstacles under water to interfere with her sailing qualities and affect her, if she should take the ground or run foul of ropes or wreckage. (7) Should anything happen to the rudder, she will steer well with the turbine alone; and, with both together, her manœuvring power is far in excess of any other known steering arrangement. (8) The deck hands arrive at the wreck fresh and ready for their work. He then described the vessel in detail (full details of which, with illustrations, we gave in our September No.). In conclusion Mr. Green stated that the action of the Royal National Lifeboat Institution in adopting that new departure in lifeboats had awakened a lively interest in the subject amongst their neighbours abroad, and most of the Continental lifeboat services had asked to be furnished with full particulars of the boat. There was no doubt that steam having now been introduced into lifeboat work would soon become a powerful factor in that most important branch of marine institutions. The lifeboat had been carefully tested and proved by the National Lifeboat Institution's officers, and they were consequently enabled to place their boat on one of their most dangerous stations without any misgivings as to the result.

Mr. J. I. Thornycroft, whose firm constructed the engines and boilers of the steam lifeboat, said he would like to see the length of the boat increased, because it seemed almost a waste of power to have so short a boat. The boiler seemed specially suitable because of its lightness, and 100 lb. pressure of steam could be attained in twenty minutes. He was sorry Mr. Green d not mentioned the coal consumption of the boat.

aptain Chetwynd, of the Royal National Lifeboat Institu- said Mr. Green had given a most temperate and moderate iption of the boat. She had so far realised all that had predicted of her. It was, however, desirable that one point should be known—that although this promised to be a complete solution of the difficulties of one part of the lifeboat service, he did not see it held out any hope as yet of mechanical propulsion for lifeboats in general, because her weight and size were in the first place prohibitory to its use in the case of ordinary boats. It was absolutely necessary to keep down the weight of the majority of the lifeboats, and the only use he could see for the steam lifeboat was in connection with harbours. The National Lifeboat Institution was exceedingly glad to find this result, and for the purpose of relieving harbours they had no doubt it would prove a success.

Mr. Reckenzaun thought that in the near future electricity would be used with advantage in the propulsion of lifeboats. The batteries might be placed in the hold as ballast, and the whole internal space might then be devoted to passengers, so that instead of 30 persons 100 might be placed on board.

Mr. Corbett considered that the adoption of the hydraulic propeller was a perfect success for its purpose, but thought the machinery was too complicated, and in order to provide a reasonable safeguard, the whole of the machinery and boilers ought to be duplicated. The boat had certainly solved the problem of the practicability of steam lifeboats, and he took a much more hopeful view of the further application of steam to lifeboats than Captain Chetwynd.

Mr. Nathaniel Barnaby felt that Mr. Green's firm was to be congratulated on the very great success which had attended this boat, and if ever hydraulic propulsion was justified, it was in this instance. He certainly could not regard the engines as too complicated, and the boiler seemed to be the simplest that could be used for the purpose. He expressed high appreciation of the way in which Messrs. Green had carried out the design.

The Chairman said it seemed quite clear that the mechanical propulsion of lifeboats was an established success, and Mr. Green was greatly to be congratulated on the results achieved. The principle of hydraulic propulsion was now likely to become practically and thoroughly tested. He had great pleasure in moving a vote of thanks to Mr. Green.

Mr. Green acknowledged the compliment, and thanked the audience for the attentive consideration given to the paper.

TRIAL TRIP OF THE "EMPRESS OF INDIA."

The first of a fleet of three steamers, designed to provide an accelerated service between Vancouver and Japan, has just completed her trials between the Clyde and Liverpool. She is named the *Empress of India*, and her sister ships will bear the names of *Empress of China* and *Empress of Japan*. They are all three built by the Barrow Co. for the Canadian Pacific Railway Co., and are part of the scheme projected some three years ago for procuring an efficient and rapid means of communication with China, Japan, and India, exclusively through British territory. A subsidy of £60,000 a year, made up of £15,000 from the Canadian Government and £45,000 from the Imperial Treasury for providing this improved fleet between Vancouver and Hongkong, adds importance to the incident from the point of view of the British taxpayer. The scheme, in its larger scope, included a fleet of fast steamers of the first-class to run between Plymouth and Halifax or St. John's in the Bay of Fundy, a sea passage 600 miles shorter than that between Liverpool and New York, and capable of being covered in less than five days. Indeed, steamers at present running on the Atlantic could do the journey, under favourable circumstances, in four and a half days from railway platform to railway platform, without the inconvenience arising from the bars at New York and at Liverpool. There is also projected as another and essential part of the Imperial scheme, and as an alternative to the Suez Canal route, a line of steamers between Vancouver and Australia, and negotiations are now being carried on for postal and Admiralty subsidies, to which the Colonial and Imperial Governments, it is hoped, will contribute, to enable the line to hold its own. Both the Atlantic and the Australian service are in the meantime in abeyance, although a contract was actually signed by the managers of the Orient Line for the Atlantic service before the subsidy was voted and before application was made to the public for the necessary capital to build the three steamers, of which the *Empress of India* is the first. After the Pacific subsidy had been secured, two leading members of the Canadian

Pacific Railway retired from the Atlantic scheme, and the Orient Co. felt it prudent to relinquish it, and the China service was alone gone on with. The abandonment of the Atlantic service is important, because, in the opinion of the postal authorities, the proposed accelerated service between Vancouver and China and Japan is of no value without the proposed accelerated service between London and the eastern terminus of the Canadian Pacific Railway.

In our last July number we gave two double-page illustrations, showing general arrangement, poop, promenade and forecastle deck, upper deck, main deck, and lower deck. Her hull has been carefully coated with Hartmann-Rahtjen's composition.

The *Empress of India* is a twin screw steel steamer of 5,920 tons gross; 485 ft. long; 51 ft. broad, and 36 ft. deep. She can carry 120 first-class passengers, 50 second, and 600 steerage. The two sets of engines are triple-expansion, the three cylinders being respectively 32 in., 51 in., and 84 in. in diameter, with a 54 in. stroke. The boilers are only four in number, double-ended, and with four furnaces in each end, making 32 furnaces in all. The diameter of the boilers is 16 ft., the length 19 ft., and they work at a pressure of 160 lb. The diameter of the screws is 16 ft. 6 in., and at full speed on the mile they gave, with 85 revolutions, a mean, on four runs, of over 18 knots with assisted draught. The highest speed attained was 18·65, and the speed contracted for with natural draught at sea is 16½ knots. The whole of the internal fittings and decorations in the better parts of the ship are of wainscot oak and white and gold, with the exception of four special rooms, which are of dark mahogany and gold. Every first-class cabin is provided with an ingeniously contrived writing table, and the berths can be pulled out to make a three-foot bed.

The subsidy of £45,000 from the Imperial Treasury depends upon certain conditions prescribed by the contract of the Post Office and the Admiralty with the Canadian Pacific Railway Co. The Admiralty requires a speed of 17½ knots on the measured mile and 16 at sea, with power to hire the vessel at 20s. per ton per month, or buy it at cost price, less 6 per cent. per annum depreciation and *plus* 10 per cent. for compulsory sale. The platforms for guns and the extra stiffening are also prescribed, and have been complied with in the construction The Post Office contract extends for ten years, and prescribes a monthly service between Halifax or Quebec and Hong Kong, calling at intermediate ports, within 684 hours in summer and 732 in winter, with penalties of £500 for failure to start at the fixed time, and £100 for every 24 hours delay. The penalty for late arrival is fixed at £100 for every 12 hours. It is a ten years' contract, but can be terminated by the Postmaster-General on six months' notice and the payment of £20,000 The contract, which is dated July 15th, 1889, was approved by the House of Commons on August 16th following.

The trials were conducted under the supervision of Mr. Bryce-Douglas on behalf of the builders, and Mr. Kearsey for the Canadian Pacific Railway Co. Mr. Bate, of the Constructor's Department of the Navy, represented the Admiralty, and Mr. Messum, the Controller of Contracts, represented the Post Office.

H.M.S. THUNDERER.

On January 10th the double-turret monitor *Thunderer* made a full-power official trial of her new engines at Portsmouth. The ship was in command of Captain M'Gill, the Admiralty being represented by Mr. Mayston, the contractors' firm by Mr. Richard Sennett, Mr. Sells, and Mr. Warriner, the dockyard by Messrs. Corner and Wishart, and the Steam Reserve by Mr. Heffernan, Chief Inspector of Machinery.

The propelling machinery consists of two sets of inverted triple-expansion engines, manufactured by Messrs. Maudslay, Sons & Field, of Lambeth, of the collective power of 5,500 horses with natural draught, and 7,000 horses with forced draught. Each set has a high-pressure cylinder 34½ in. in diameter, an intermediate cylinder 51 in. in diameter, and a low-pressure cylinder 76 in. in diameter, with a stroke of 3 ft. 6 in. The engines work with a steam pressure of 140 lbs. per square inch, and are fitted with surface condensers having a total cooling surface of 9,000 square feet. Steam is provided by four main boilers and an auxiliary boiler.

The sea was tolerably smooth, the wind blowing with the force of 4, which was just sufficient when outside the Nab to cause a low wave. The immersion of the ship was 24 ft. forward and 26 ft. 6 in. aft, giving a mean trim of 25 ft 3 in. From the beginning of the run and through every successive hour the contract power of the engines was exceeded, so much so, indeed, that the engines were not pressed The mean results of the entire run were—steam in boilers, 125 lb.; vacuum, starboard 28·85 in., and port 29 in. (an extraordinary mean for eight hours); mean pressure, starboard engine, high 39·42 in., low 24·20 in., intermediate 13·31 in., port engine, high 42·30 in., low 28·50 in., intermediate 13·67; total I.H.P., starboard 2,855, and port 3,057, giving a collective I.H.P., of 5,912 or 412 horses beyond the contract. The difference between the performances of the two sets of engines is accounted for by the fact that 2 deg. of port helm were necessary to keep the ship straight in her course. The result of the first four hours gave a mean of 6,025 horses, and, as this was unnecessarily high, to meet the stipulations the engines were eased down, and the air-pressure in the furnaces, which began with 2·5ths of an inch, was reduced, so that the average of the whole trial amounted to ·44 in., which was slightly below the Admiralty conditions Although no official rates of speed were taken, in consequence of the condition of the ship's bottom, yet the average of two runs on the measured mile gave a speed of 13·923 knots. The trial was eminently satisfactory, and though the engines were contracted to develop 7,000 horses under forced draught, it is not proposed to subject them to the test, and they will be received from the contractors in consequence of their having more than satisfied the conditions with natural draught. After completion the *Thunderer* will relieve the *Téméraire* in the Mediterranean.

LAUNCH OF H.M.S. "SYBILLE."

Another cruiser for the British Government was set afloat on the Tyne during the closing days of 1890, the vessel in question being H.M.S. *Sybille*, which was launched on Saturday, the 27th December, from the shipbuilding yard of Messrs. Robert Stephenson & Co., Limited, at Hebburn. The launch of this vessel is an important event in the history of the old-established firm of Robert Stephenson & Co., this being the first war ship constructed by them, and marks an important departure in their business. It is now sixty years ago since the firm first became famous through the extraordinary success of the now historic "Rocket" locomotive made by them at their engine works, South Street, Newcastle; and during the succeeding years the good reputation then earned has been maintained and strengthened in the extensive operations carried on by them in locomotive and marine engine building and general engineering work. Some five years ago, following the now prevailing fashion among large industrial concerns, the old firm of Robert Stephenson was converted into a private limited liability company, a large shipbuilding yard was acquired at Hebburn, and the business of shipbuilding added to the various branches of engineering previously carried on by the firm. Since the shipyard was opened in 1887 several important contracts have been executed there for the Honourable Corporation of the Trinity House, the Wilson Line, Messrs. F. Stumore & Co.'s Tower Line; the Shaw, Savill and Albion Company; Messrs. Money, Wigram & Co., Limited; the Hamburg-American Steamship Company, and other influential ship-owning concerns; and it is no little compliment to the firm, considering the short time they have been engaged in shipbuilding, that the Lords' Commissioners of the Admiralty should have entrusted them with an order for the construction of an important war ship. The *Sybille* is one of the 29 second-class protected cruisers of the *Apollo* class, to be built under what is generally known as the "programme" authorised by the Naval Defence Act of 1889. She was designed by Mr. W. H. White, Chief Constructor of the Navy, and is 300 ft. long, 43 ft. beam, with a displacement of 3,400 tons on a draught of water of 16½ ft. There is a protective deck extending from stem to stern, and sheltering the boilers, magazines, steering gear, &c. Above the protective deck the space is minutely sub-divided, coal bunkers, cofferdams, &c., being built as is usual in vessels of the "protected" class. The hull is divided into about 75 separate watertight compartments below the protected deck, and there is a double bottom extending the entire length of the engine and boiler space, its continuity being maintained forward and aft to the ends of the vessel by means of the watertight platforms of the magazines, shell, and store rooms. The bow is specially strengthened for ramming. In all respects the vessel is made suitable for independent sea service, and for being driven at a high speed in rough water. She is rigged with two polemasts, having only fore and aft steadying sails, and depends upon her steam power and twin screws for propulsion. Her engines, which are being supplied by Messrs. R. & W. Hawthorn, Leslie & Co., Limited, St. Peter's, are capable of developing 9,000 I.H.P., with forced draught, under which conditions it is expected the vessel will attain a speed of 20 knots per hour, whilst a speed of 18 knots is looked for under natural draught. The engines being of the vertical type, the cylinders project above the water line, and are protected by a casing formed of armour plating 5 in. thick, fitted against strong teak backing with steel lining. There are five boilers, and the closed stokehole system of forced draught has been adopted. The vessel is armed with two 6 in. guns, six 4·7 guns, nine smaller quick-firing guns, four Nordenfeldt guns, and one boat's gun, and there are four torpedo tubes, one in each broadside, one forward and one aft, all being under cover. A steel conning tower is fitted on the forecastle deck, and contains the necessary means of communication with the various parts of the ship so that she can be controlled in action. The electric light is fitted throughout the ship, and there are three powerful search lights. The construction of the ship has been superintended on behalf of the Admiralty by Mr. H. Pearce, of Devonport dockyard, assisted by Mr. T. H. Smith, of Sheerness dockyard.

A large and influential company witnessed the launch, the proper form of prayer to be used at the launching of Her Majesty's ships was read by Rev. E. A. Langston, Vicar of St. Cuthbert's, Hebburn, and the christening ceremony was performed by Mrs. Robert Stephenson, wife of one of the managing directors.

THE BELGIAN MERCHANT FLEET.

At the commencement of 1890 Belgium had a merchant fleet of 42 steamers and 9 sailing vessels, and 42 of these 51 ships belonged to the harbour of Antwerp. The most important shipbuilders are the Cockerill Co., the American-Belgian, the International Congo Society, whereas the Congo Railway Co., Lamberts & Engels, and the Asturian Mining Society also manufacture ships' plates.

Cockerill constructed during 1889, in his Hoboken dockyard, four express steamers for service on the Volga, one steamer for Lisbon, a steamboat for the penny traffic in the basin of Antwerp, further altered the steamer *Magellanis* into a four-mast sailing vessel, rebuilt for the Paris Transatlantic Co. the s.s. *Bost* and *Tarn*, 84 mètres long by a width of 10·8 mètres and 7·05 mètres depth. Each of these two vessels weighs 1,950 tons, and is provided with an engine of triple-expansion, and of 1,250 H.P. In the same dockyard, the *City of Dorres*, for the Ostende-Dorres service, is being constructed. This boat will make 19 knots an hour. There are further in the course of construction two cargo boats of the *Tarn* type, one steamer for Russia, an express boat for the Volga traffic, another one for Congo, and a small one for Greece. With the exception of the year 1880, when 4,483 vessels entered the port of Antwerp, the year 1889 witnessed the largest number since 1830, viz., 4,370 ships; and as to tonnage, the period exceeded every former year. The aggregate of 4,050,706 tons represented an average of 925 tons per vessel against 906 in 1888, 683 in 1880, and only 153 tons in 1840. The arrivals in 1889 were 3,608 steamers, (1888: 3,503), and 771 sailing vessels (1888: 769). To the grand total of 4,050,706 tons, the English flag contributed 2,354,680 tons, or 58½ per cent.; the German, 612,990; the Belgian, 446,441; the French, 137,917; the Norwegian, 131,917; and the Danish flag, 123,231 tons. The entrances at other ports were 875 ships of 395,517 tons, besides 140 small crafts of together 20,140 tons in Ghent; 27 vessels of 3,475 tons in Louvain; 430 of 151,269 tons in Ostende; 53 vessels of 13,229 tons in Newport; and 10 of 1,184 tons in Tirmonde. There were besides 225 fishing boats in Ostende, 12 in Antwerp, 53 in Blankenberg, 52 in Pann, 41 in Gleyst, and 9 elsewhere.

SHIP LIGHTING BY ELECTRICITY.

It is little more than eleven years since the *City of Berlin* proudly sailed from Liverpool with the hitherto unheard-of maritime embellishment—the electric light.

To think of an ocean-going steamer of the first order, with three arc lamps in her saloon, considering herself uncommonly favoured, is to us now amusing; but a London vessel about the same time put to sea—without a visible smile from captain to cook—with one solitary arc lamp on board, claiming an engine and dynamo all to itself.

Some conception may be formed of the elementary nature of the knowledge of this subject in the possession even of the most intelligent engineers at that time, when we say that Mr. John S. Raworth (then representing Messrs. Siemens Bros., of London), who was consulted with regard to the *City of Berlin*, had the greatest difficulty in persuading those concerned that the dynamo must not on any account be driven by the main engines; in fact, prejudicial though it was, that a separate engine would have to be employed.

Those of our readers who keep pace with the ever increasing accessories of a ship's engine-room will readily contrast this state of things with the present. It is now by no means uncommon to find four distinct sets of electric generating plant, three of which supply upwards of 1,000 incandescence lamps fixed throughout the ship, the fourth engine and dynamo being held in reserve for emergency.

The first installation of incandescence lamps was also carried out on an Inman vessel, the *City of Richmond*, though at this time the parallel system of distribution was so far unappreciated that the extra cost of conductors involved by its adoption was considered prohibitive, consequently the lamps were arranged in groups, these being fed in series from a high-tension Brush machine. This cumbersome system was, so far as we are aware, never repeated, and the first ship to be lighted on the present lines was the *City of Rome*, which was placed in Mr. Raworth's hands, who made two new departures, neither of which are out of date to-day: one was the introduction of the endless rope driving, and the other the "single wire" system.

By far the larger number of ships are wired on this system, by which the electric current, after passing through a lamp, finds its way by a short length of wire to the nearest accessible point of the iron hull of the ship, through which it returns to the negative terminal of the dynamo, which is, in like manner, connected to the ship's hull. Although much has been said of late about the effect on the compass produced by this "ship return" system, it is a curious fact that no case has ever been reported where so large a deflection has been observed as on board one of H.M. ironclads where the double or "return wire" system is in use.

A case has recently come under our notice in which a small deflection was observed after fixing a new and more sensitive compass, but attention had only to be called to the fact and it was speedily put right.

The single wire not only economises conductor, but it is obviously more difficult to completely isolate two conductors from each other which everywhere run side by side only about half an inch apart, with hundreds of tee joints and crossings unavoidably much closer, than it is to keep one wire from the hull of the ship which you can make it a rule not to approach within several inches if necessary.

The wiring of ships has not undergone any very important change since the early days, except that the conductors are disposed of in a more workmanlike manner in suitable castings. There is, however, a tendency at the present time to introduce lead covered conductors, in which the Admiralty are pioneers. For their purpose we have no doubt that the change is for the better, but for the mercantile service, where wood fixings exist almost throughout, we consider it an unnecessary expense, except of course for special cases. Even for engine-rooms, highly insulated conductors drawn into iron piping is preferable to lead covering, on account of its mechanical strength.

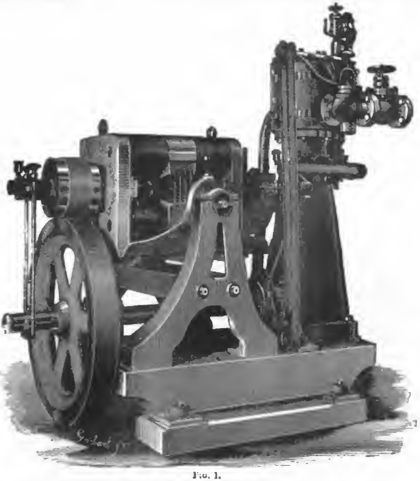


Fig. 1.

In the matter of switches, cut-outs, lampholders, &c., great improvement has taken place by the use of metal and porcelain only, but in the matter of fittings, such as brackets, pendants, &c., it must be a matter of some satisfaction to Mr. Raworth—who, by-the-bye, has for some years past held the position of superintendent-engineer to the Brush Electrical Engineering Co. (and its predecessor the Anglo-American Brush Co.), to know that his original designs have become standards throughout the industry, whilst the Admiralty retain as their standard to the present day his "Polyphemus" design of switchboard.

In connection with fittings we may mention a very ingenious device, designed by the Brush Electrical Engineering Co., for side and masthead lights, first put in use, we believe, on one of Messrs. Donald Currie's boats. It consists of an electro-magnet with an armature, upon which two glow lamps are mounted, so controlled by a spring that at the moment of the electro-magnet ceasing to be energised, through the failure of the first lamp, the armature automatically swings round and not only puts the second lamp in circuit, but at the same time places it in focus.

Passing finally to the generating plant we find here the greatest cause for congratulation. Horizontal engines speedily give place to vertical, lubricating arrangements were rendered as automatic as on the main engines and wearing surfaces as adjustable, belts were superseded by endless ropes, which permit of extremely small centres, both first introduced by Mr. Raworth, when agent for Messrs. Siemens Bros., and finally by direct coupling with its absence of all gearing whatsoever, whilst the dynamos are now compound wound, to maintain constant pressure at the lamp terminals irrespective of the amount of load, are rendered sparkless at the brushes even at the present low speeds, and are of much higher efficiency and, above all, reliable.

We are told, by way of illustrating this last quality, that a set of friction gear supplied by the Brush Co. to the Orient Steam Navigation Co. some three years back has been running to Australia and home again night and day without stopping, except in London, practically ever since first put on board.

We illustrate the two representative types of plant above referred to, and as now constructed by the Brush Co. The friction gear (Fig. 1) is made in sizes from 2,400 watts to 15,000 watts, *i.e.*, from 40 to 250 lamps of 16 candle-power each. The dynamo is carried by a cradle supported on trunnions in such a manner as to bear lightly on the pulley. The engine shaft is prolonged and carries an accurately turned flat-faced flywheel, upon which the dynamo pulley rests. The latter is constructed of paper put together under a hydraulic press, and is also accurately turned flat. A tightening arrangement comprising a roller bearing on the extended end of the dynamo shaft beyond the pulley clamped by long bolts with spring washers under the nuts to a half-bearing on the engine-shaft outside the flywheel, permits of the pressure between the two friction surfaces being so regulated as to prevent slip without producing undue strain upon the dynamo shaft. By this arrangement the space required is reduced to very little, if any, in excess of that occupied by a direct coupled plant of the same output; the engine is run at as low a speed as is desirable, whilst the dynamo retains its normal speed and consequent diminutive size.

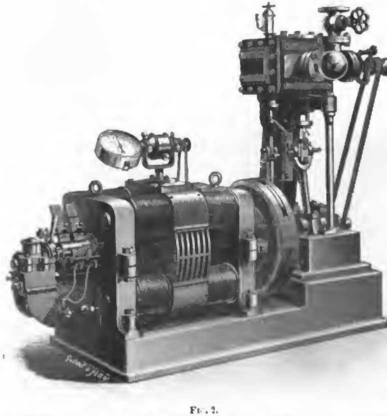


Fig. 2.

In direct coupled generating plant the question of balance between size of dynamo on the one hand, and speed of engine on the other, is an all-important one. Obviously for a given output, the size of the dynamo increases as its speed is reduced, and for this reason great efforts have been made to construct a satisfactory high-speed engine, for ship use, for coupling rigidly to the dynamo shaft. The most successful of these is the single-acting engine of Messrs. Willans & Robinson, but the disadvantage of a closed-in engine with the crank inaccessible whilst running, together with the double connecting rod necessitated by their special valve gear, and the lightness of reciprocating parts, the attendant weakness to resist sudden rushes steam, so often met with at sea, are considered by many engineers who have given them a fair trial to outweigh their undoubted advantages in the matters of weight and space occupied. The British Admiralty now use rather high speed double-acting engines as the outcome of their large experience in both single and double-acting types. A plant which develops 32,000 watts (equal to 533 lamps of 16 candle-power each, say 64 I.H.P.) is run at 320 revolutions per minute as their solution of the critical speed, but it remains to be seen whether the increased wear and tear on the engine is justified by the saving in size of dynamo and the reduced weight of the combination.

The direct-coupled set of plant is the latest development of the Brush Co.'s experience, who through the acquisition of the Falcon Engine Works, at Loughborough, have the great advantage of manufacturing the whole of the apparatus themselves, an advantage which is increased by the large amount of experience they are able to bring to bear upon every detail. The set represented (Fig. No. 2) develops 7,000 watts at about 300 revolutions, and can run for several weeks uninterruptedly if desired. Single cylinder sets are made by this firm from 2,000 watts up to 18,000 watts, at speeds varying from 400 to 200, and double cylinder engines from 7,000 watts upwards. All their high-pressure cylinders are fitted with piston valves, and the wearing surfaces throughout are large, adjustable, and extremely well lubricated automatically. The dynamos are of such a design as to be easily dismantled for inspection or repairs, the field magnets and framework being split horizontally so that the removal of the upper half exposes one half of the armature, which, still resting on its bearings, can be easily turned by hand to bring any point uppermost. This admirable feature is not lost upon sea-going engineers who have had experience of both the

"Victoria" and other types of dynamos in which accessibility is conspicuous by its absence.

The Brush Co. have also resisted the temptation to dispense with one of the bearings of the dynamo and couple the armature shaft solid to the crank shaft. This is of course cheaper, but unsatisfactory when the engine bearings begin to wear; they therefore invariably use a flexible coupling, which allows for any unequal wear without producing bending-strains on the shaft, or hot bearings. It is also found to be a great advantage to have the dynamo self-contained, both in erection and overhauling.

The design of the whole plant is excellent, and we understand that it is held in high favour at sea.

Although the first cost of ship lighting is somewhat heavy—from £4 to £5 per lamp, according to the size of the installation—we understand that the working expenses are less than with oil for a given amount of light, whilst the convenience and safety of the newer illuminant is beyond all comparison.

We do not see any reason why all ocean-going steamships of any size, whether engaged in passenger traffic or otherwise, should not be supplied with electric light even on the ground of comfort of the crew alone, much more on the score of immunity from risk of fire and the facility with which light is obtained in emergency in any part of the ship.

THE ROYAL NAVAL EXHIBITION, 1891.

SINCE our notice in last December's issue, of this Exhibition, the executive committee have concluded their arrangements with the executive of the late Military exhibition, and have now entered into possession of the buildings and ground lately occupied by them. The Committee have also secured an additional four acres of ground from the Commissioners of Chelsea Hospital, which they have now enclosed for the purposes of the Naval Exhibition.

On this new ground there is in course of erection on the north side, by Messrs. North, a large gallery for the exhibits of Sir Wm. Armstrong & Co.; on the east side, a large new gallery, by Messrs. Humphreys, to be named the Camperdown gallery, with lavatories attached; and kiosks for the exhibits of the Fairfield Shipbuilding Co., the Thames Iron and Shipbuilding Co., and Messrs. J. & G. Thompson. On this new ground there is also in course of construction a large water basin 250 ft. by 150 ft. This is being made by the Messrs. Webster at their own expense; and on the south-east part there will be erected a model of H.M.S. *Victory*, all the parts of which shown will be of full size. A grill room, premises for the exhibits of the P. & O. Co., and a building for the exhibition of Tyler's Panorama of Trafalgar, are the other important erections in this new ground.

The whole buildings and grounds will be lighted by the electric light, the installation of which has been entrusted to Messrs. Siemens Bros. & Co., and we understand that as many as 10,000 coloured lamps will be used in illuminating the grounds. The pyrotechnic department will be under the charge of Mr. Payne, and some elaborate naval displays may be expected from him. In the matter of music, the executive have already made some important engagements with celebrated bands. In the course of the exhibition, among others, the four divisional marine bands will perform, the bands of the Royal Engineers and the Coldstream Guards, and the well-known band of Mr. Wellington has been engaged as the stock exhibition band, under his leadership. There will thus always be two first-class bands in the grounds, besides that of the naval boys.

A feature in the exhibition will be a lighthouse, the erection of which is already begun. It is being constructed by Mr. Charters at his own expense, and will be the same as that which did duty at the Liverpool Exhibition. It will be 140 ft. high, and 44 ft. broad at the base, and will be lighted by Messrs. Chance Bros., of Birmingham.

There will be a number of galleries named after several celebrated old school admirals, including Cook's gallery, which will be devoted to navigation exhibits, Howe's gallery, Blake's gallery, Nelson's gallery, Benbow's gallery, Sepping's gallery, which will be devoted to models, and the St. Vincent gallery, which will be devoted to ordnance. A gallery for machinery is also provided, and there are refreshment and dining-rooms, lavatories, shooting gallery, a dairy, and a press-room, band stands, &c., and altogether everything is being done for the comfort, amusement, instruction, and convenience of the visitors, the attendance of which we hope will be very large, as the exhibition will undoubtedly merit the public patronage.

SERVE RIBBED BOILER TUBES.

IN our November issue, pages 346—8, we fully described a series of trials of the "Serve Ribbed Boiler Tubes" which were carried out at Messrs. John Brown & Co., Limited, Atlas Steel and Iron Works, Sheffield. Since that time the boilers used for the experiments have continued at work, and under all kinds of draught, and the "Serve" tubes have continued to give the most satisfactory results.

In a long experiment, on January 15th, the No. 1 boiler (fitted with "Serve" tubes) gave out steam equal to 650 I.H.P., under high induced draught, and had fully 15 per cent. greater evaporative efficiency than No. 2 boiler with plain tubes, besides effecting a slight saving of fuel.

Recently the steamer *Phra Nang*, built and engined by the Fairfield Shipbuilding and Engineering Co., Limited, had the boilers fitted with the "Serve" tubes, for comparison with a sister ship in which plain tubes were fitted in the boilers. Both steamers proceeded out to China, where they are to be regularly engaged in trading, the sister vessel preceding the *Phra Nang*. It was anticipated that a favourable opportunity thus occurred for a first-class everyday working trial, and so it has proved, it being now reported to the builders of the steamers "that the 'Serve' tubes have behaved quite satisfactorily throughout the voyage to China, and have shown an appreciable saving in the coal bill."

As there has, however, been various circumstances which render an exact comparison impossible as to the actual performances of both vessels, the owners prefer that the *Phra Nang* shall run for three months on her station in China, as against the sister ship, before publishing a detailed report of the exact economy derived from the "Serve" tubes.

Meanwhile it is satisfactory to Messrs. John Brown & Co., Limited, to have such a favourable report, confirming as it does the experience of the Compagnie Générale de Navigation, Lyons, which has now nine steamers constantly trading in which the boilers are fitted with Serve tubes—that the tubes involve no practical difficulty in everyday use, and cause no delay or annoyance in cleaning. It has been alleged that in case of Serve tubes going out they would be difficult to "stopper," but we understand that this presents no difficulty in practice, so that superintendent engineers need have no hesitation on that score for delaying to give the "Serve" tubes a trial.

As regards the "Serve" tubed boiler, in use at Sheffield, we understand that further experiments are about to be made in the direction of demonstrating that with high accelerated draught such as the British Admiralty require, the diameter of the tubes, if of the "Serve" type, can be largely increased (the form of the tube providing greatly increased strength) in order to avoid the choking of the tube ends in the firebox, now giving so much trouble in the case of plain tubes of small diameter, and that this improvement can be obtained whilst obtaining as great an evaporation per pound of fuel as is now the case with small ordinary tubes.

Our readers will see that this latest departure in boiler-making promises to be one of the most important effected in recent years.

Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, have received an order from the Canadian Government to build a steel screw steamer, to be fitted by the builders with a set of their patent quadruple-expansion engines to indicate 1,000 H.P.

The Delta Metal Co., Limited, of 110, Cannon Street, E.C., inform us that they have appointed as secretary Mr. Y. W. Meyjes, who has been connected with them for several years.

LIST OF VESSELS LAUNCHED IN 1890.

• Compound. † Triple.

GERMAN.

By Johann Lange, Grolm, Vegesack.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
I. W. Wendt	—	Sail	German	1,745	—
Charlotte	—	,,	,,	1,230	—
Concordia	—	,,	,,	1,250	—
Barge	—	,,	,,	60	—

RUSSIAN.

By Baltic Works, St. Petersburg.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
• Polar Star (Imperial yacht‡)	Steel	T. S.	Russian	—	6,000

‡ Principal dimensions:—Length on water-line, 315 ft. 6 in.; breadth, extreme, 76 ft.; depth to main deck, 26 ft.; draught of water aft, 18 ft. 6 in.; forward, 17 ft. 1 in.; displacement, 3,640 tons.

AMERICAN.

By The Wm. Cramp & Sons Ship and Engine Building Co., Philadelphia.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
† Venezuela	Iron	Steam	Am'can	2842·9	2,000
† H. M. Whitney	,,	,,	,,	2706·62	2,850
† Essex	,,	,,	,,	2530·86	1,500
† Algonquin	,,	,,	,,	2832·66	1,330
† El Sol	,,	,,	,,	4522·74	4,000
† Newark	Steel	,,	U.S.Nvy	4,083	8,500

AUSTRIAN.

By A. Tischbein & Co., Trieste.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Trubant	Steel	Steam	A'strian	546	1,000
† Pola	,,	,,	,,	185	60
• Umberto	,,	,,	Foreign	40	20
• Bojena	,,	,,	A'strian	202	25
† Victoria	,,	,,	Foreign	414	60
• Sofia Cuppa	,,	,,	,,	385	60
• Aidin	,,	,,	,,	66	40
• Archipel	,,	,,	,,	65	46
† San Ginoto	,,	,,	A'strian	1,900	160

The above arrived too late for our January number.

THE FRENCH MAIL STEAMER "AQUITAINE."

THIS vessel, built to the order of the Societé Generale de Transports Maritimes à Vapeur of Marseilles, sailed from the South Docks, Sunderland, on January 18th, for Genoa and Marseilles to take emigrants and passengers from these places to South America. The particulars of the vessel were given at the time of her launch, and which we now repeat, as the details of such vessels will doubtless prove interesting to the shipping community. Her length between perpendiculars is 350 ft.; breadth, extreme, 42 ft. 6 in.; depth, moulded, 29 ft.; gross tonnage, 3215·02, and net 2047·51. She is built to the spar-deck rule with full poop, long bridge, and top-gallant forecastle, under the highest class at both Lloyd's, Bureau Veritas and English Board of Trade certificates for passengers, and is constructed with Z frames, the bottom being on the cellular principle all fore and aft; the after tank is specially arranged for carrying fresh water for emigrants' boiler, service, &c.

The spar-deck is of pine with a partial steel deck underneath, the main and lower decks are both of steel, and the poop deck of teak; the main and lower decks are fitted with berths for 1,200 emigrants, the beds for which are of the owners' special pattern in iron. In the poop aft there is accommodation for 20 first-class passengers, and the saloon is very handsomely fitted up in various shades of solid oak, relieved with gilt fluted pilasters of the same wood, and bevelled plate-glass mirror in each alternate panel, and the whole of the hardware is in electro-plate; oak swivel chairs are fitted to all the tables, and the sideboard at the fore-end of the saloon is in various kinds of hardwoods. The baths are at the after-end of the poop, and are handsomely fitted up with tiled floors, &c. On the poop deck is a large smoking-house, which also forms an entrance to the cabins, and is entirely fitted out in teak. The second-class cabins are on the main deck, immediately beneath the first-class saloon, and contain berths for 40 passengers. The saloon, which is very large, extends the full width of the ship, and is lighted by a large trunk skylight, extending to the poop deck.

All the officers' accommodation, and the bars, wine stores, restaurants, galleys, oven and bakehouses, &c., are beneath the bridge alongside of the engines and boilers. On the top of the bridge forward there is a steering-house in the centre, captain's house on the starboard side, and charthouse on the port side, each supporting the flying bridge. The firemen are placed amidships alongside the engine-room, and their quarters are fitted out complete with lavatories, &c., and iron beds. The most complete system of ventilation is fitted throughout the ship on account of the hot climate in which the vessel trades the greater portion of her time at sea.

The waiters have quarters on the lower deck aft alongside the baggage department and ice-room. The mails and bullions are placed on the main deck abaft the after-peak bulkhead. The crew are berthed under the spar deck forward, at which part are also the numerous and various store and provision rooms, cattle, sheep, and fowl pens, butcher's shop, &c. Two large hospitals are fitted forward, one for men, and the other for women; also a mortuary has been built at this part of the ship. The winches on deck are four in number, all by Messrs. Clarke, Chapman & Co., and the steam steering gear is the "Harrison" gear, which is placed in the engine-room and worked by bevelled gear from the wheelhouse forward.

The engines are of the latest type, and built by the North-Eastern Marine Engineering Co., Limited, at Wallsend on Tyne. The cylinders are 28 in., 45 in., and 73 in. by 48 in. stroke, steam being supplied by two large double-ended boilers with 7,200 feet of heating surface. The donkey boiler is a horizontal one, by Riley Brothers, and is placed on the spar-deck. The condenser, for making fresh water, is by Messrs. C. M. Row & Co.; and the sanitary arrangements of the vessel are most complete in every detail, conveying hot and cold water throughout. Gilmour's evaporator and feed heater have been supplied; also Hocking's condenser for supplying fresh water for the emigrants. At the first trial trip of the vessel, which was made for speed alone, a most satisfactory result was obtained, viz., 13·55 knots mean on a 6 hours' run, being 1½ knots in excess of the contract. This result was obtained with 2,000 tons of cargo on board. The second trial trip, which extended over 24 hours, was made for the purpose of testing the consumption of fuel, the result being 1½ lbs. of north country coal per I.H.P. per hour, which was also within the contract stipulation. During construction, the ship and engines have been surveyed by Mr. H. C. Ashlin, of London and Liverpool.

YARROW'S TUBULOUS BOILER.

THE construction of boilers, on the locomotive principle, for torpedo boats and other vessels using forced draught, has long been a feature of the business of Messrs. Yarrow & Co., of Poplar, London. These have hitherto been remarkable for safety and freedom from leaky tubes, and have given every satisfaction.

While Messrs. Yarrow & Co. have not in the slightest degree lost their confidence in this type of boiler, when properly constructed, yet, as steam pressures have gradually risen in the past, and may therefore probably continue to do so in the future, and when that pressure has already reached 200 lbs. per square inch, the question of adopting a new form of boiler becomes a matter of primary consideration.

For some years back this firm had carefully studied this subject, with the result that they have now given to the world their patent water-tube boiler, which seems to combine the necessary features of a successful steam generator and one suitable for practical work.

The boiler now submitted for public inspection, and which forms the subject of our illustrations, is one fitted on board a second-class torpedo boat built for the Argentine Republic. This boat is 60 ft. long by 9 ft. 3 in. beam, having, when fully loaded, a displacement of about 15 tons, and is fitted with triple-expansion surface-condensing engines capable of indicating 250 H.P. This boat is of a type of which the firm has built a very large number, both for the British and Foreign Governments, to serve either as part of the equipment of large ironclads, or for the defence of the harbours and coasts of the smaller powers. The average speed of these boats, when fitted with locomotive boilers, has been 17 knots; this one, however, when fitted with the new type of boiler, has obtained slightly over 18 knots.

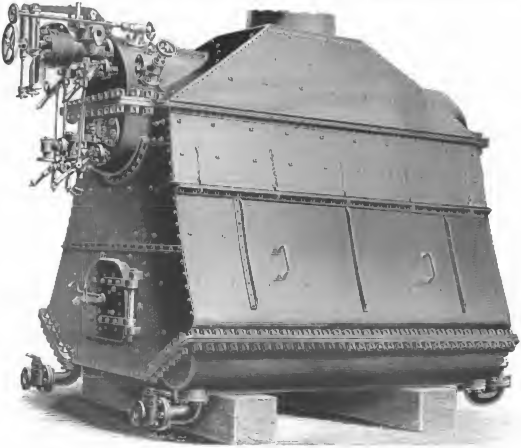


Fig. 1

We append, further on, a table giving the results attained by this boat so fitted, when tried at Long Reach on the Admiralty measured mile.

The boiler under consideration consists of a cylindrical upper part of about 20 in. in diameter by 6 ft. long, and two lower prismatic water pockets, also about 6 ft. in length. These three chambers are subdivided longitudinally, so as to give free access to their interiors in every part.

The upper cylinder, when at work, is about half full of water, and is connected to the water pockets by a large number of straight, galvanized steel tubes (section shown in Fig. 3) slanting downwards at an angle of 30 degrees, and forming, in section, a body something like an inverted letter V, of which the firegrate forms the base. The longitudinal division of the chambers permits of these tubes being examined withdrawn, and renewed from time to time with the greatest facility.

The flames rise from the furnace and pass to the right and left in between the slanted tubes and thence round the top cylinder, and so on to the funnel, which is placed above the centre of this latter. These tubes, under all circumstances, are completely filled with water, and cannot, therefore, become overheated. The essential matter of circulation is maintained in this system by the inner tubes, subject to the greatest heat, having an upward current, and the outer ones, subject to lesser heat, having a downward current, and from experiments which have been made both on a model and the full-sized boiler itself, this has been proved to be carried on with the utmost rapidity.

This boiler has some remarkable features. Although, from its peculiar construction, it might be expected to prime, yet it is absolutely free from this trouble, which is a general failing of almost all tubulous boilers when pressed, and is therefore, as we have stated, highly suited for use in combination with forced draught.

Again, the union of the tubes in the tube plates has never shown the least sign of leakage, and, comforting to the timid, it cannot, under any circumstances, explode.

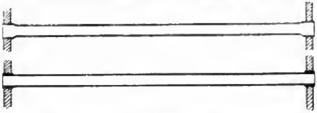


Fig. 3.

Tubulous boilers are no new inventions, but, like all things else, they are capable of improvement. Hitherto those constructed seem to have been of a complicated nature and somewhat intricate in design. The tubes were often in several lengths united together by elbows, or bent into fantastic shapes, preventing the possibility of internal cleaning, and presenting great difficulty in case of repair. The present boiler seems to offer no such obstructions, and the only point remaining in any doubt, is as to its durability when compared with the locomotive type. To determine this, sufficient time has not yet elapsed, and the question cannot be settled until a number of them have been in constant work for at least ten years, which is the life, under ordinary circumstances, of locomotive boilers when adapted for marine purposes.

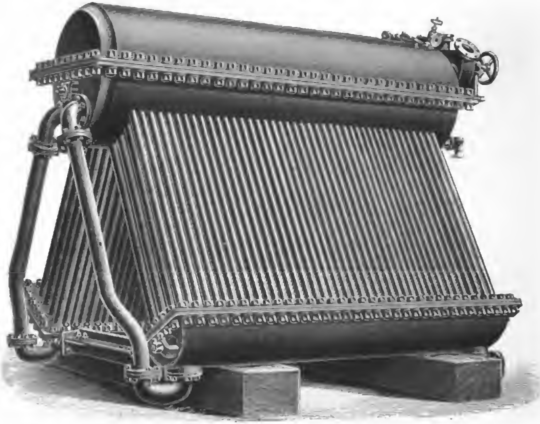


Fig. 2.

These boilers are constructed in every part of steel, and corrosion has been guarded against by each boiler, when so far finished, being placed in the bath and thoroughly galvanized throughout, both internally and externally. It is also to be stated that their power of generating steam is far in advance of the ordinary boiler, in fact steam can be raised of a working pressure in the one we have described in 20 minutes from the time of lighting the fire.

We will conclude our brief description by giving, in tabulated form, the results of the official trial, on 23rd December last, of the second-class torpedo boat we have referred to, and which was fitted with this new boiler, from which it will be seen that a speed was attained of fully one knot more than has yet been got with a boiler of the ordinary locomotive type, although under precisely the same conditions. The load on board was two tons.

Steam lbs.	Vac.	Air.	Rev. per min.	Time H.M.	Speed Knots.	1st means	2nd means	
170	23	2·7	570	3·8	19 672			
170	,,	3·2	577	3·47	15 859	17·765		
170	22·7	3·5	568	3·1	19 890			
171	22·5	3·3	680	3·46	15 929	17·909	18 021	
172	22 7	3·2	597	2·57	20 338	18·133	18 098	
172	23·	3·6	578	3 48	15 789	18·063	18·121	Admiralty mean, 18·113 knots
174	22·5	3 1	582	2 55	20 571	18·180	18·215	
173	23·	3·4	583	3·46	15 929	18·250		
172	22 7	3·35	578					

Mr. D. Thomson, engineer, &c., of 85, Canston Street, Poplar, E., received an order from Messrs. R. & W. Hawthorn, Leslie & Co., Limited, St. Peter's Works, Newcastle-on-Tyne, for five double and two single ended boilers, to be fitted with his speciality for combined circulators and feed water heaters. This, we understand, is a repeat order.

AUXILIARY ENGINES ON SHIPBOARD.

At the seventh ordinary meeting of the session of the Institution of Civil Engineers, held on Tuesday, January 13th, Sir John Coode, K.C.M.G., President, in the chair, the paper read was on "Auxiliary Engines in connection with the Modern Marine Engine," by Mr. William Henry Allen, Assoc. M.Inst.C.E.

The paper dealt with the early introduction of auxiliary engines for marine engines, beginning with the year 1870, when the surface condenser was fairly established and the marine engine had assumed the form of the twin-compound engine.

Circulating Pumps.—Descriptions were given of the form of circulating pump used first in the *Arizona*, which reached its maximum size in the engines on board the *Umbria*, and also of the pumps which had been adopted for the large triple-expansion engines of the North German Lloyd Fleet, and it was shown that the quantity of water required for condensing purposes had been reduced from 20 lbs. per I.H.P. per minute in the compound engine, to 11 lbs. in the triple-expansion engine. The author recommended that the speeds for centrifugal pumps for large boats should be 150 revolutions per minute, so that the machines should be fairly light, and yet possess full security from breakdown. The custom of duplicating had fallen into disuse, and most of the boats at the present time were fitted with single engines. Cast-iron was to be preferred for centrifugal pumps in lieu of gun-metal, experience having shown that it was proof against the action of sea-water. So far as the author knew, no experiments had been carried out on the condensing plant of marine engines, and consequently the data for regulating the size of the machines must be those obtained from practice. The author had found the friction of the condenser tubes, together with the velocity of entrance, as well as the friction of the circulating pipes themselves, to be equivalent to a head of from 5 ft. to 10 ft.; that was to say, that in calculating from the speed of the centrifugal pump, as well as the quantity of water known to be delivered at this speed, from 5 ft. to 10 ft. of water was the pressure against which he had found it necessary to work.

Comparing the quantity discharged with the I.H.P., the efficiency, with this head and with the moderate number of revolutions at which these pumps were operated, was found to be 50 per cent. This result was with a velocity of water of from 9 ft. to 10 ft. per second through the circulating pipes, which was usual in ordinary merchant steamers. In the Navy much higher velocities had been used—in some instances 15 ft. per second, at which speed the duty of the centrifugal pump would be considerably diminished. The above efficiency must be considered fairly good when the large range of power for which the engines were constructed was taken into consideration. In twin-screw steamers safety of working was in a large measure assured by cross-connecting the circulating pumps, so that in case of emergency either of them could be employed for condensing the steam from both engines. This method, which had been recently carried out in the new mail boats, *Empress of India*, and two sister vessels, for the Canadian Pacific Railway Co., was shown in diagrams exhibited. In this ship the circulating pumps were attached to both condensers by cross-connections, with a system of valves. Each pump was provided with two engines, either of them being powerful enough to provide water for its own condenser for circulating, and the two together capable of working the pump at a sufficiently accelerated speed to provide water for both condensers. This method had the advantage of keeping down the area of the cylinders for circulating, while still retaining full power for bilging also.

Separate Air Pumps.—The practice of entirely disconnecting the air and feed pumps from the main engines and working them by their own steam cylinders was one which had not been universally adopted, but there were several instances of such separate sets of engines at work giving great satisfaction. They consisted of inverted cylinders working the necessary air pumps direct, and having connections to feed, bilge, and sanitary pumps on the crosshead, the strain acting through the piston-rod and crossheads directly on the pumps, an intermediate three-throw crank of ordinary description and flywheel on either end making the complete machine. These had been found to work very satisfactorily in the *Normannia* and other steamers of this class where they had been employed.

Fans for Forced Draught.—Fans for forced draught had been introduced on a large scale in the City of Dublin Mail Steam Packet Co.'s line running between Holyhead and Dublin, in the year 1883, and had since then been fitted to the vessels of the following lines:—The boats running between Belfast and Glasgow, the Liverpool and Isle of Man boats (4), Liverpool and Llandudno (2), Holyhead and Dublin (4), City of Dublin Steam Packet Co.'s (5), London and North-Western new steamers (2), Great Western boats running between Weymouth and the Channel Islands (3), Brighton and South Coast boats running between Newhaven and Dieppe (2), Chatham and Dover boats running between Dover and Calais (3), and the Netherlands Steamship Co.'s boats running between Queenborough and Flushing (4). From this list it would be seen that all the principal lines of passenger steamers running from England to neighbouring shores had been supplied with fans. Forced draught, however, had by no means been confined to coasting steamers, as recently all the Atlantic liners, as well as some boats trading to Australia, had been equipped with assisted-draught fans of various kinds. Mention was made of Holt's China Line, the Orient Line, and also of the *Majestic* and *Teutonic*, in which fans for assisted draught were applied. At present the pressures for forced draught varied from ½ in. of water upwards, according to the system, but until further progress should be made in high-pressure boilers the author was of opinion that pressure exceeding ¾ in. of water in the ashpit was not advisable, as it involved leakage in the tubes, and other troubles. Experiments made both in England and abroad showed that the large variation in the quantity of air required in the different systems made it almost impossible to give any proper rule. An instance of this might be found in the introduction of forced draught. The fans supplied to the later Queenborough and Flushing boats were some 18 in. less in diameter than those of the earlier ones, and gave equally good results. These fans were employed only for assisted draught, but considerable benefit had been obtained with them, particularly when the wind was abaft the funnel, as the stokers then found the greatest difficulty in maintaining the pressure. The same might be said of steamers which travelled in the trade winds. All these fans were driven direct from their own engines, as it was impossible to work a high-speed belt properly when it was placed longitudinally with the ship, which was generally the most convenient way of arranging the fans. This, together with the proximity of dust and grease, rendered the system an unsafe one. All fans for high-speed engines should be secured to a substantial foundation. To bolt a high-speed fan against a thin plate bulkhead, without supports, would largely increase vibration, and possibly fracture the baseplate. The speed proper for the fans depended upon their diameter and the amount and pressure of air required; but as these had to be accommodated to the maximum speed which could be obtained without excessive wear and tear, for quick-running engines a speed of from 250 to 350 revolutions per minute might be regarded as the most satisfactory for long voyages. The efficiency of the combined fan and engine was not high, the best results obtained by the author being only 42 per cent., with fans of from 4 ft. 6 in. to 6 ft. in diameter, suitable for steamship purposes. It was highly desirable to keep up the areas of the cylinders, so that in the event of the steam pressure dropping, the cylinders should be sufficiently large to maintain the full speed required by the fan, and thus recover the pressure. For calculating the areas of the cylinder, an efficiency of 35 per cent. would insure the engines being of ample power.

Reversing Engines.—At about the time centrifugal pumps were introduced, the auxiliary engine employed for the purpose of operating the reversing links of the main engines came into use. The form of engine first employed, and which was now in common use on small steamers, was that known as the roundabout engine. It had a cylinder of from 5 in. to 8 in. in diameter, working the ordinary wheel motion. The crank on the second shaft was connected either to the weigh-shaft of the main engines or to the links themselves, and arranged so that the links might be reversed ahead and astern. The reversing action took place by turning the steam into the exhaust by the ordinary central valve. For engines up to 150 I.H.P., where there was plenty of room, this arrangement answered the purpose well. It was also useful for heating up the main cylinders before leaving port by starting at slow movement, when a small volume of steam would be admitted on both sides of the main piston by the fact of the reversing engine bringing the links backwards and forwards from ahead to astern. While this form had been generally adopted for small engines, it had been almost entirely superseded in large ones during the last ten years by the direct-acting reversing engine. This was known as the hydraulic reversing engine. It consisted of a steam cylinder, the movement of the piston of which was controlled by an oil cylinder. These reversing engines were always fitted with automatic cut-off gear, so that the movement of the small hand lever which controlled the steam valve was followed by the motion of the reversing engine only so far as was necessary, the automatic gear cutting off the steam and oil at the position corresponding to that in which the engineer placed the handle. This automatic cut-off controlling gear consisted of a set of differential wheels and levers which were positive in action; they were either connected to the weighshaft or to the crosshead of the reversing engine, and by links and levers to the valves on the reversing engine. The operation of altering or reversing the position of the links having been accomplished, the hydraulic cylinder took upon itself the function of a locking gear, a valve preventing the oil from passing from one side to the other, and so securing the piston in the required position. The liability to thrusting of the link blocks was greatly lessened by the employment of the oil cylinder.

Electric Lighting Engines and Dynamos.—These were among the latest additions to the engines placed under the care of the seagoing engineer, but they had come into use so rapidly that it was now the practice to fit up cargo steamers, as well as passenger steamers, with them. The difference in the comfort of a ship furnished with electric light, instead of oil lamps, could only be judged by those who had had experience of both. A paper on this subject was read before the institution by Mr. Jamieson, in 1884, since which time considerable advances have been made in perfecting the engine and dynamo for ship work. In the interval, nearly every variety of engine had been tried—turbine three-cylinder, rotary, single and double acting, open and closed, high and low-speed; but the general opinion appeared to be that the double-acting engine, specially constructed for driving dynamos, was the form which would find the most favour for marine work. At the present time electric light machinery might be classed under two heads, viz., that specially suitable to Admiralty purposes, where the highest economy and efficiency were the principal qualities required; and that appropriate for ordinary merchant steamers, where a good practical engine and dynamo were looked for before economy, except in some of the best Atlantic liners where combined engines of economical form might be found.

The question of driving dynamos direct from engines or by rope gearing had, the author thought, been settled by the general adoption of the direct-working machine, the advantages of dispensing with belting and gearing, where oil, grease, and water were sure to be present, being very great.

The author was of opinion that progress had been largely accelerated by the close specifications issued by the Admiralty, without which latent ability would not have been developed and such great improvements effected in so short a time. The economy of engines and dynamos had been improved, both by increasing the efficiency of the dynamo and by reducing the quantity of water required by the engine itself. Naturally, with a higher pressure of steam, combined with the use of the condenser, considerable reduction could be made by way of economy. It would also be seen that these engines had in themselves several advantages over closed engines, namely, accessibility, simplicity, and fair economy, combined with the all-important point of durability. It must not be forgotten that the twin-engine with cranks at opposite angles, such as was exclusively used at the Admiralty, had the advantage of working with considerably less vibration than the single-cylinder engine. For the Mercantile Marine, however, an altogether different type seemed to be preferred. With the exception of some of the largest liners, nearly all vessels were at present being fitted with single-cylinder, direct-acting engines and dynamos, the object of the owners being to secure a machine which should run constantly without repair or breakdown, and one which could be readily understood by ordinary marine engineers, and repaired by them when necessary.

The ship-lighting dynamo had been greatly improved during the last year or so, and the drum-wound armature machine was one which had been found to work satisfactorily. The armature consisted of a cast-iron hub mounted on a steel spindle, having laminated plates for the core, the whole being drum-wound on the outside. Every part at all likely to get out of order was visible, and could be readily repaired by those in charge of the machine. The voltage at which the author had found it most convenient to work in merchant ships was 60 volts, which was suitable for glow lamps as well as for projectors.

Bearing in mind that the electric light engine had generally to work harder and longer than any other in the ship, the light being required both when in port and at sea, the matter of economy was of some importance. The efficiency of ordinary ship-lighting dynamos, such as those which had been constructed by the author with double-acting engines, was in some cases as high as 83 per cent. The efficiency of dynamos of the ordinary mercantile form was over 81 per cent. This result had been obtained from a number of machines of similar size, the engine and dynamo combined being tested from no load to full load.

The above description of auxiliary engines did not by any means exhaust the list of those which were to be found in the marine engine-room of the present day, as mention might be made of the present form of feed pump, which was generally of the duplex pattern without flywheel; also the evaporator with Weir's hot-water feed-pumps; refrigerating apparatus, which had generally the horizontal compound engine with air pumps opposite to same; the steering gear, which was sometimes placed in the engine-room; the small engine for turning the engines round when in port; the distilling machinery; the air compressors employed when the cabins were ventilated by nozzles; and the ash hoists. The paper had, however, extended so far that it would be impossible to embody all the details of these engines, and the author had preferred to confine himself to the four classes of engine which were within his own experience.

TRIAL TRIP OF THE S.S. "OBIDENSE."

On January 16th the trial trip of the *Obidense* took place off the mouth of the river. A large party of guests accepted the invitation of Messrs. Singlehurst. Among those present were Mr. T. Royden, M.P., Councillor J. Houlding, Capt. Jarvis, Capt. H. Jones, Capt. W. C. Jarvie, Sen., Messrs. Thomas M'Cracken, George Hephurn, W. H. Pellow, James Kendall, Henry Shield, H. P. Cleaver, Thos. Andrews, F. Brocklehurst, J. B. Cnrtis, John Keppie, C. Birchall, R. Watson, E. O'Niel, G. Goverin, G. A. Hepburn, D. Kippie, W. Isaacs, S. M'Mullin, K. M'Mullin, J. Hephnrn, C. H. Bishop, F. A. Gordon, J. Higgs, Smith, D. Davidson, J. Tarhuck, Thos. Royden, Jun., S. Milligan, J. Page, J. M'Giliveray, J. Bruce, J. Wilson, H. E. L. Grundy, W. E. Blackhurn, R. B. Hooper, P. H. Wakem, J. Nessfield, D. Layborn, G. H. Little, C. Singlehurst, G. Wilson, Arthur Leyland, J. H. H. Sutton, S. Hahn, T. Henderson, H. M. Liardet, W. Oglethorpe, D. Howell, W. Picknp, G. A. Harradon, G. Goodwin, J. Wilkie, A. Currie (Board of Trade), and W. Stewart. A series of runs were made with the following results:—Mean draught about 15 ft.; steam in boilers, 175 lbs.; in M.P. receiver, 65 lbs.; in L.P. receiver, 11 lbs.; vacuum, 27 in.; revolutions, 75; total I.H.P., 2,900; mean speed, 17 knots. The H.P. and speed are largely in excess of the contract, and it is anticipated that when laden a mean speed of 14 knots will be maintained at sea. The *Obidense* is a steel-built single-screw steamer, built by Messrs. Royden & Sons. She is 300 ft. long, 37 ft. beam, and moulded depth of 26 ft. When at the load draught of 21 ft. (mean) she carries 2,800 tons of deadweight. The hull is built of steel, with frames of channel section. The vessel is built much in excess of the classification rules, and has an unusual amount of strengthening in the shape of extra stringers and intercostals. She is a flush-decked ship, with two iron decks, and has a full poop, long bridge, and top-gallant forecastle. She has accommodation for 80 first-class and 200 steerage passengers. The accommodation for the former is in the bridge-house amidships. Briefly stated, the saloons and first-class cabins are similar in furniture and appointment to the *Teutonic* and *Majestic*, of the White Star line. This means that the *Obidense* offers its passengers the most luxurious accommodation. The furniture and upholstery fittings of the ship are remarkable for elegance of design and high-class workmanship. They have been supplied and fitted by Messrs. A. Blain & Son, of Liverpool. The main saloon and the cabins occupy the fore part of the bridge-house. Abaft the saloon are the pantry and galley, so arranged that the culinary productions are passed directly into the saloon, thus avoiding any cooling. All the plate and cutlery have been supplied by Messrs. Higgs & Smith, of Liverpool, and, needless to say, is of the best quality.

Under the bridge deck are the officers' and engineers' rooms, all very comfortably furnished. On the bridge deck is the smoking-room, a very elegant apartment, fitted up with handsomely decorated marble panels by Messrs. John Stubbs & Sons, of Liverpool. On the fore-side of the smoking-room is the captain's cabin and chart-room, above which is the upper bridge and steering house, replete with all the needful accessories for safe navigation, in the shape of compasses and other instruments, supplied by Messrs. J. Bruce & Son, of Liverpool. The bridge deck forms a most pleasant promenade, and adds very much to the comfort of the passengers. On the bridge deck, carried on skids, are four lifeboats, and on the poop are a cutter and gig, all the boats being abundantly well found. Under the poop deck are the cold rooms, store-rooms, steering gear, &c. The machinery, made and fitted by Messrs. Fawcett, Preston & Co., consists of a set of tri-compound engines, the cylinders being 29, 46, and 74 in. in diameter, with a stroke of 48 in. The cylinders, which are carried on cast-iron box columns, are unjacketed, and, with their valve chests, are all bolted together. Piston valves are used for the H.P. engine, while Thom's patent balanced valve is fitted to the M.P. engine, and Thom's ordinary slide valve to the L.P. engine. The valves are worked by double bar link motion of the usual type. Tail-end piston rods, working in closed-in sleeves, are fitted to all three pistons. The reversing gear is of the direct type, and is effected by the connecting rod of a horizontal steam cylinder, coupled directly to the drag links. Dunlop's marine governor is also fitted. The shafting, interchangeable with cranks 120 deg. apart, is of wrought-iron, the crank pins being of steel. All the bearings and rubbing surfaces are of extra large area, and the means of ensuring lubrication are of the most approved type. Messrs. Quiggin have supplied their well-known oil cups and sight feed lubricators. The condenser, of the usual pattern, is placed behind the columns. The air pump, circulating, bilge, and feed pumps being placed behind the condenser, and worked off the L.P. cross-head in the usual manner. The thrust is of the open "horse-shoe" type, the collars being faced with white metal. The auxiliary engines in the engine-room are "Quiggin's" evaporator, Hockins's fresh water condenser, "Deane" feed-pumps, and the well-known "Pulsometer" ballast pump. The propeller is a right-handed four-bladed one of cast-iron. Steam is supplied at a working pressure of 175 lbs. per square inch by two double-ended steel boilers. Each boiler has eight furnaces, four at each end, with a combustion chamber common to each pair of opposite furnaces. The latter are Purves's ribbed ones. A great saving in manual labour and an increase in the boiler efficiency has been effected in the *Obidense* and one or two other steamers of the Red Cross fleet by the adoption of Henderson's self-cleaning furnaces, which effectually prevent the necessity of that crude and wasteful process known as "cleaning fires." In these days of marine engine economy, high pressure steam loses half its value if the fire doors of the furnaces are kept open one after the other while fires are being cleaned. By Messrs. Henderson's rocking fire bars the fires are kept automatically "pricked up," so that perfect combustion is ensured without the harmful rush of cold air which usually accompanies the operation of trimming the fires. These self-cleaning furnaces are steadily growing in favour with marine engineers, and we hear them highly spoken of. On the upper deck over the main boilers is a large donkey boiler, which supplies steam to the winches and electric light engines when the ship is in port. Other auxiliary machines are Harfield's patent windlass and engine, Hall's patent stockless anchors, cargo winches fitted with Mr. George Hepburn's disc friction gear, which renders these winches practically noiseless when working, and Alley & MacClellan's "Sentinel" steering engine. The *Obidense* has a very good electric light installation, which has been supplied by Messrs. McMullen, of Liverpool. The plant consists of a 10-unit Kapp dynamo, coupled direct to an Allan high-speed engine. At a speed of 250 revolutions the dynamo supplies 170 amperes at an E.M.F. of 35 volts. There is also a dynamo of similar output, driven at a speed of 600 revolutions by means of a vertical engine and belting and jockey-wheel on Messrs McMullen's well-known system. All the switches, fuses, cables, leads, &c., are of the best quality. For working the cargo at night time each hatch is supplied with electric clusters and hold lamps. In case of a breakdown there is a complete set of mineral oil lamps throughout the ship. From the foregoing description it will be gathered that the *Obidense* is really a very high-class vessel, and reflects the greatest credit on her designer, Mr. George Hepburn, N.A., of Liverpool, who has been associated with Messrs. Singlehurst for a great number of years, and also on her builders, Messrs. T. Royden & Sons, and above all on her owners, who are evidently determined that they will spare no pains to maintain their position in the South American trade.

THE CANAL MOVEMENT.

AMONG the most important phases of the subject of the transportation of industrial products in the United Kingdom, which have occupied a conspicuous position in the forefront of debated questions of the year 1890, has been the activity and interest shown in the development of internal navigation. Probably the year that has just passed has been more marked than many of its predecessors in this respect. All over the four continents of the globe designs have been promulgated for the increase of canal facilities, and it would seem that, considering the prevalence of strikes in our own country, among those who are not only employed in the manufacture of commodities but who are engaged in the removal of that traffic, the improvement and reconstruction of our obsolete waterways is a matter of considerable importance and pressing moment to the satisfactory maintenance of the essentials of transportation. In addition to the congress on inland navigation held at Manchester in July last, there have been books and pamphlets written bearing upon the subject, and likewise the presentation of a Bill to Parliament for obtaining the necessary powers to carry out the development of canals. There seems almost to be a mania, a revival of an earlier spirit, for the severance of any isthmus, by the intersection of a canal, which increases the distances, and prevents the occupation of the smallest period of time for vessels travelling from one part of the world to the other.

The canal through the isthmus of Corinth, in Europe, whereby the Piræus of Greece and Western Europe will be brought a great deal closer, although the length of the canal itself will be only about four miles; the lamentable undertaking of the Panama Canal—into which so much French capital and labour has already been sunk, and for the completion of which it will require about as much again—in America, the Nicaraguan Canal, a scheme launched in opposition to that of Panama; the proposed Russian Canal, uniting the capital, St. Petersburg, with the White Sea; another project for the construction of a new canal in Hungary near the Irongates of the Danube; the suggested canal on Egyptian soil, as well as in the Empire of India, and the islands of Japan, show us fairly well that there is a general movement for the greater utilisation of water as a means of transport.

Our own country is not far behind in this tendency, for the Manchester Ship Canal, and the proposed Forth and Clyde Canal, will undoubtedly be beneficial to the trade of the kingdom.

It is not, however, so much the construction of new canals that the United Kingdom stands in need of as the modernising of the already existing ones, and this is a work which bristles with difficulties from many causes.

Most of the European countries have canal systems remarkable for their efficiency, and on which there is carried a large amount of the traffic of the country. There is, however, a vast difference in their government, as in France, Belgium, and Germany for instance, the State has a vested interest in both railways and canals. In England this is otherwise, and it is hardly to be expected that the railway companies, which are private undertakings, will co-operate in, or sanction any endeavours to raise up a power of opposition to their own interests, and out of the three thousand odd miles of canals in the United Kingdom, about 1½ thousand miles are under the jurisdiction of the railway companies. Such transport, of course, as canals could afford would be insufficient for the great proportion of the internal traffic, although the charges would be much less than by rail. Whatever may be the designs of those who propose to take up the question of the improvement of canals it is certain that the task before them is one bearing many obstacles, and there is also not a little possibility of their efforts receiving an unproportionate return in the way of dividends.

THE SHIPMASTERS' FEDERATION.—A combined meeting of delegates of the newly-formed federation of shipmasters' societies will be held in London on February 2nd, when the beginning of a new movement will be organised for the purpose of raising the status of ships' officers educationally and financially.

A NEW STEAM PACKING FOR THE PISTON-RODS OF MARINE ENGINES.

THIS invention is intended to secure a perfectly tight packing joint in the glands or stuffing boxes against the piston-rods of marine engines.

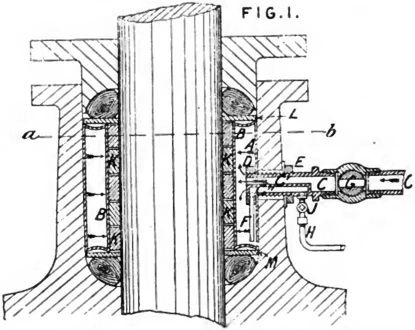
It consists of a double cylinder of any suitable metal so inserted as to exactly fit within the stuffing box, and made so as to be perfectly steam tight, leaving at the same time, an annular space between the inner and outer cylinders. Space is provided for packing of the most approved description to be placed round the piston-rod between it and the inner side of the double cylinder, and a pipe connection through the stuffing box leads into the annular space between the cylinders. This pipe is connected to the main delivery pipe conveying the pressure in use from the boiler, and is fitted with a valve so as to permit of the main direct pressure being admitted and regulated at will to this annular space. The steam thus admitted acts upon the entire surface of the inner cylinder, which is thus caused to yield, and to a certain extent, give inwardly, and so presses against the entire outer surface of the packing, causing the latter in turn to uniformly force tightly home against the rod, thus securing a perfectly reliable joint. By this method scoring of the rods caused by packing being unequally screwed or forced down is avoided, and the friction is reduced to a minimum, and the very objectionable effect of steam or other pressures mixing with the packing, as a means for keeping same well up to the rod, is entirely done away with.

The inventor has further provided for a subdivision of the pipe passing through the stuffing box to the space between the cylinders, so that one subdivision may admit the steam pressure throughout from the main, while the other subdivision, which is open at the end for a certain distance, is fitted with a short tube connection dipping therefrom, and a further small pipe is led through this same subdivision, having a cock, so that, when any escape or leakage appears from the gland this cock may from time to time be opened, thus enabling any condensed water formed in the hollow metal cylinder to be blown off, through the pressure contained, by aid of the small dip pipe. When this is removed and the small cock closed, the steam may then be directly permitted to fully and freely again act on the surface of the internal cylinder, and as we have already said, cause it gently to extend and press upon the entire outer surrounding surface of the packing and keep it close and well up to the rod.

The drawings we here give will fully illustrate the nature of the invention.

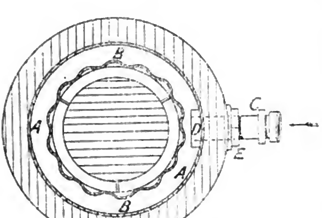
Fig. 1 shows a vertical section of a stuffing box, and Fig. 2 is a cross-section of same at the line *a b* of Fig. 1.

FIG. 1.



A is the external cylinder connected at the upper and lower ends, and forming part of the inner internal cylinder B, which is constructed of the most suitable metal to withstand great pressures, and at the same time to be fully sensitive in action as required for the purpose. CC in Figs. 1 and 2 is the pipe connecting to and through the stuffing box, and leading into the annular space between the cylinders A and B. At or about the central portion of the external cylinder A, a nut D is brazed into its internal surface, and to the outer face of the stuffing box, a corresponding nut E is provided. F is a small tube fitted into and just through the nut D, which is led downwards into the lower space between the cylinders A and B, so as, as previously mentioned, to enable the condensed water to be blown into the lower divisional part C'' of the admission pipe C. C' is the continuation part of the pipe C for admitting steam under pressure from the main. G is a valve regulating the pressure of steam to be admitted into the space between the cylinders A and B. H is a small pipe with valve J in connection with the division pipe space C' and the dip pipe F, to permit of the escape of the condensed water. K is the packing placed between the piston-rod and the inner face of the cylinder B upon which, on steam pressure being admitted to the annular space between the cylinders A and B, a very steady and uniform pressure is given off against its whole surface by the inner face of the cylinder C, thus closing and keeping it securely against the piston-rod. A metal ring or rings, L M, is also provided and placed in the gland just above and below the external and internal cylinders A and B, and above and below these, flexible packing is introduced.

FIG. 2.



It will be observed that in Fig. 2 the internal cylinder is shown as corrugated, but we understand that in some cases the inventor prefers that the sides of both cylinders should be plain, but that the upper and lower portions which connect the cylinders together should be corrugated, so as to assist the working of the internal cylinder and make its action somewhat similar to that of a "diaphragm."

The patentee of this unique invention is Mr. S. A. Johnson, of 13, East India Road, Poplar, London.

HYDRAULIC BOAT-HOISTING MACHINERY

DURING the past month there have been carried out on board the new torpedo depôt ship *Vulcan*, at Portsmouth, a series of trials of hydraulic boat-hoisting machinery, supplied by Sir W. G. Armstrong & Co., of Elswick, which have attracted more than ordinary interest in consequence of the novelty of the fittings introduced for the first time in a ship. Chief among these is a pair of enormous "goose-neck" cranes, placed one on each side of the deck, almost amidships, and which present to a seaman's eye a most ungainly appearance. These cranes are, in fact, huge davits, whose total height is 65 ft., with an overhang, or, technically, "rake," of 38 ft. It will be readily understood that a bent beam of these dimensions, and weighing about 27 tons, requires special arrangements for its support and security. To provide these about 30 ft. of the total height lies buried in the hold, passing down through the upper, main, and protective decks to the bottom of the ship, where the foot rests upon a special steel casting bolted to the structure of the vessel. In the upper deck is secured a heavy steel ring or socket, which takes all the canting or capsizing strains, and in which the crane rotates. The beams themselves are built of steel plates and angles on the box-girder principle, but specially strengthened and stiffened. By this method of construction, the lifting machinery is permitted to be erected within the pillar of the crane, well down in the hold, and consequently protected from gunfire, while the portion above the protective deck is screened by an armoured tube. The lifting machinery consists mainly of two cylinders of 17½ in. and 5½ in. diameters fitted with rams, which have a vertical travel or stroke of 10 ft. The small cylinder plays a very important part in the working of the mechanism. Both rams are rigidly attached at their upper ends to a huge crosshead which carries four sheaves on a pin at right angles to the axis of the cylinder. At the lower end of the cylinders are four sheaves corresponding in vertical line with those above, the whole thus forming a system of pulleys differing from the ordinary systems in the fact that an enormous power is required to push the pulleys apart, and so be able to lift a comparatively small weight of 20 tons or so. The thrust exerted on the crossheads by the rams at the ordinary working pressure of 1,000 lbs. per square inch is about 118 tons, one-fourth of which only is available for lifting purposes, owing to the multiplying power of the pulleys, which increases the 10 ft. stroke to a lift of 40 ft. The ropes, 5½ in. in circumference, are of steel wire, and of such strength and tenacity that a direct fall of 90 tons failed to fracture them. The most interesting feature in the mechanism, and one for which a patent has been obtained by the firm, is the attachment of the small cylinder already mentioned, the special duty of which is to hold and keep taut the slings after they have been hooked on until a favourable moment for hoisting the boat presents itself. This is of the utmost importance in a seaway as a preventive against accidents. The arrangement of valves is such that the main lifting power cannot be applied until the small cylinder has been brought into action. It also provides for the escape of the water when the ram is driven back by the falling of the boat.

The turning or slewing motion of the cranes is effected by means of two cylinders fitted with rams 16 in. in diameter, and having a direct thrusting force of 90 tons. These are placed vertically alongside the pillar of the crane, and the rotatory motion is given by admitting the pressure to one or other of the presses. The cranes have a turning range of 250 deg., which will enable a boat to be picked up from alongside the ship and deposited in almost any position on deck. It is, however, obvious that, since the *Vulcan* is 58 ft. wide and the cranes are 40 ft. apart, it would be impossible, without special devices, to lift a boat remotely situated from the part where the crane is fixed. In order, therefore, to provide for the contingency of one of the cranes becoming disabled in action or by accident, the torpedo boats (of which the ship carries six) are stowed in crutches fitted on trolleys actuated by worm gearing and moving upon rails, by which means they can be conveyed from one side of the ship to the other.

The cranes have been subjected to two tests. The first test consisted in hoisting the full working load of 20 tons through a lift of 40 ft. at the rate of 90 ft. per minute, traversing it through the entire range at a speed of 45 ft. per minute, and lowering the load. The load was next increased to 25 tons, and it is intended eventually to increase the weight to 40 tons, or double the ordinary working load, when the ship is further advanced, before the gear is accepted from the contractors. Every part of the machinery successfully withstood the tests, the droop being inconsiderable and the permanent set about an inch.

The service derrick attached to the mainmast for boat-hoisting purposes has also been fitted with hydraulic machinery. In this case the working load is 10 tons, and the tests consisted in lifting this weight through the full lift of 25 ft. from the water level at a rate of 90 ft. per minute, topping the derrick with the load on at 20 ft. per minute, and slewing it into position with the bollards. The derrick was also required to hold, top, turn into position, and lower a load of 20 tons in order to test the endurance of all the parts. The lifting machinery only was supplied by the contractors in this case, the derrick and its fittings having been manufactured by the ship contractors.

In addition to the cranes and derricks, there are on board four hydraulic bollards, or winches, for use with the derricks and for general hauling purposes. These are guaranteed to be equal to a direct pull of 30 cwt. The water pressure for working the machines is maintained by two sets of horizontal tandem compound engines, which drive the force pumps, and use steam at 100 lb. pressure. The trials were conducted under the supervision of Staff-Engineer George A. Haddy.

LARGE IRONCLAD.—A very large ironclad, with a displacement of 12,480 tons, is being built at Nicolaieff for the Black Sea fleet.

THE GLASGOW INDUSTRIAL EXHIBITION.

No. I.

THE Glasgow East End Industrial Exhibition, opened by Lord Lothian, Secretary for Scotland, on the 21st December last, is even now an assured success financially, the attendance up to date numbering considerably over 200,000. The idea of holding such an exhibition during winter first took public shape in March last, when, as the result of several meetings and conferences of a number of public-spirited residents in the Dennistoun district of the city, a committee was appointed to carry the project into practical effect. The committee at the outset were fortunate in securing the co-operation of the late Mr. John Carrick, city architect, and when the old Duke Street Reformatory and its surroundings were secured for the purposes of the exhibition, Mr. Carrick sketched an admirable plan for covering the large space of ground, extending to 60,000 square feet to the north of the reformatory, to be used in addition to the permanent buildings. A guarantee fund was started, and although at first a modest sum was aimed at, the amount actually now subscribed reaches £18,000. The exhibition has thus received every encouragement as an undertaking valuable in itself, and there is every probability that, as from the first intended, the free proceeds realized will issue in the establishment of a permanent institute "for the moral and social improvement of the working classes in the East End of the city." The buildings thus occupied as an exhibition were remodelled under the superintendence of Mr. W. V. Wylie, architect, Bath Street, under whose guidance also, a large area of ground was covered, in the form usual in the case of such enterprises—the interior being divided into a large concert hall, capable of accommodating 3,600 persons, and eight avenues for exhibits. At the rear of the concert hall is the handsome organ in use during the Edinburgh Exhibition.

FIG. 1

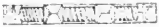


FIG. 2

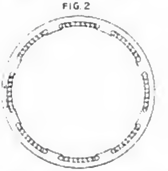


FIG. 3

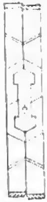
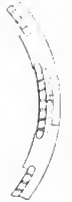


FIG. 4



In an undertaking with an object so praiseworthy as the establishment of a permanent institution for the intellectual and moral advancement, and the rational amusement of the working classes, it was but natural that many firms—especially those whose works are in the east-end of Glasgow—should contribute gratuitously to the collection brought together, or to the equipment of a show of this kind with all the most modern requisites. The actual facts fully bear out the anticipations natural in the circumstances, and not only are local firms prominent in the "complimentary list," but firms from a distance are equally to the front in gratuitous offerings.

Thus, beginning—as is most natural—with the steam generating agents, so essential in all exhibitions where machinery in motion is shown (but in this instance more essential still for the purpose of heating the buildings) we may first refer to the fitting of the Lancashire boiler (appertaining originally to the Reformatory Institution) with patent tubular smoke-consuming fire-bars by Messrs. Caddy & Co., of Nottingham. This type of fire-bar—which we described and illustrated in a recent issue—is now widely adopted both for marine and land boilers, and we are enabled to say from actual observation that its smoke-consuming and coal-saving qualities are as strikingly demonstrated at this exhibition as they have been in actual practice in so many instances elsewhere.

The boiler—which in itself was supplied to the Reformatory Institution some 15 years ago—is now embellished and rendered efficient by various boiler fittings and adjuncts supplied by the original makers—Messrs. Nicholson & Co., of Crown Point Boiler Works. The various steam connections throughout the buildings radiating from the boiler are regulated by the well-known reducing safety valves of Messrs. D. Auld & Sons, Whitevale Foundry, while the iron piping itself is from the well-known works of Messrs. Eadie, of Clydesdale Tube Works, Rutherglen, and the works of A. S. J. Stewart & Co., Limited. The traps employed in draining steam and heating pipes are those of the Lancaster type, supplied from the Lancaster Forge, of Pendleton, Manchester, whose trap for marine purposes is doubtless well-known to our readers.

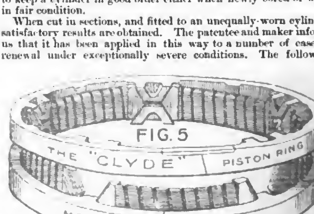
The motive power enlisted in the service of this, the machinery-in-motion section of the exhibition is chiefly that derived from gas-engines—a type of generating plant of but little use to the marine engineer. Quite a number of firms, however, are represented, among which we may name the "Otto" or "Crossley," the "Stockport," the "Fielding" and the "Acme," the last two being comparatively new. Of the "Fielding" it is said the principle is exactly similar to that of the "Otto" engine, having the four-stroke cycle. This ensures the maximum degree of efficiency, as has been thoroughly demonstrated and proved. The design and construction of the Fielding Engine is, however, much simpler than that of any other engine yet produced. Special attention is invited to the extreme simplicity of the valve gear and governor, and general efficiency of all working parts. Of the "Acme," which is particularly a Glasgow invention, we propose giving some particulars in an early issue.

As may naturally be supposed, the collection contains several patent types of steam pistons and packing, most of which are already well known to our readers, such as Rowan's patent piston, shown by Mr. John Hind, of Belfast, and Whitehead & Pollock's patent double-action piston rings, with adjustable springs for distributing the pressure equally round the cylinder. One type of comparative novelty is that shown by the inventor, Mr. James Menzies, 52, Mount Street, Glasgow. From the accompanying illustrations it will be seen that, amongst other novel and advantageous qualities, the piston rings possess the important one of independent adjustment, and have equal sections, no flanges, and maintain constant vertical pressure, while there is an almost absolute immunity from wear as regards the springs.

In this type of piston packing, when the junk ring is screwed down, the rings and springs are so bound together as to make the packing practically of one piece. The rings have no flanges and go out easily and equally to the cylinder. By fitting the body of the piston to the parts formed in the inner surface of the rings the packing is supported under shocks, and the piston under oscillations. The vertical pressure remains constant, the springs and pressing-heads not being subject to any wear whatever. The adjustments are independent, and allow either the vertical or lateral pressure to be increased or diminished as desired.

The Clyde piston ring has all the elasticity and rigidity required to keep a cylinder in good order either when newly bored or when in fair condition.

When cut in sections, and fitted to an unequally-worn cylinder, satisfactory results are obtained. The patentee and maker informs us that it has been applied in this way to a number of cases of renewal under exceptionally severe conditions. The following instances may be given:—A set was fitted to a L.P. piston, 60 in. diameter, the cylinder showing a difference in diameter of ½ in. between top and bottom. To obtain sufficient compass the ring was cut in three sections and applied in this way it has run an entire season to the satisfaction of all concerned. The ring shown in the exhibition, 32 in. diameter, is intended for the H.P. piston of the same steamer, and is also to be sectionally applied; the cylinder in this case showing a difference of ⅝ in. between top and



bottom. In one other case: of a H.P. cylinder of 33 in. diameter to which the Clyde ring was applied, the cylinder walls when examined were found badly cut, and 3-16th of an inch larger than diameter of ring. The packing—single cut—was expanded to fit the cylinder, and from its fitting in October, 1889, till now has given good results. Instances might be multiplied, but the above is perhaps sufficient to show the adaptability and efficiency of this type of piston ring under the most unfavourable conditions. It may be added that all the springs in the ring are interchangeable, except the one fitted at saw-cut section, and, as shown in perspective, both cuts are kept in the same section. In diagonal and horizontal cylinders of large diameter two springs are left out and the spaces used specially for the accommodation of chocks to support the piston. This is a novel and notable advantage in double ring packing.

Delta metal is displayed in its various rough and manufactured forms by the Delta Metal Co., of London, through their Glasgow agent, Mr. Mathew T. Brown, of 194, St. Vincent Street. Magnolia anti-friction metal is shown on a tastefully arranged stand by the Magnolia Anti-Friction Metal Co., 75, Queen Victoria Street, London. This alloy, now being extensively used for bearings in marine engines, is largely a self-lubricating compound, due to the amalgamation of graphite with other metals. On the stand is shown an old crank pin in the state in which it was left after a run of 60 consecutive hours without a drop of oil being applied, but working on a magnolia bearing, also the brasses of s.s. *Richard Anning* and s.s. *Fidele Primavesi*, which, after being entirely worn out, were lined with magnolia, and underwent over a year's severe work.

One of the newest, simplest, yet withal important, exhibits in the Mechanical Section is a "circular planing saw," which is manufactured and shown by the Planing Saw Co., Limited, of Nottingham. This machine-tool rips and planes wood at one operation, or with the same action as an ordinary circular saw. By its means a surface almost as smooth as by hand planing is attained with no more labour, and very little additional power than what is required for ordinary sawing. Wood-workers generally, but packing-box makers in particular, should derive decided benefit from this new machine-tool.

Mr. J. Miller Reid, brassfounder, &c., of 110, Lancefield-street, Glasgow, has one of the most attractive stands in the exhibition, No. 159 in the East courts. Here is displayed ships' bells and guns, Wrench's patent oblique-bladed propellor (the striking merits of which we have in a previous issue described) organ whistles, improved sight-feed lubricators, &c., &c.

NAVAL NOTES.

The Third-Class Cruisers "Barracouta" and "Blanche."

CONSIDERED as a class the *Barracouta* type of third-class cruiser cannot be said to have realised the intentions and expectations of their designers. In the all-important matter of speed they have been weighed in the scales and found wanting, and the numerous defects, which have from time to time developed themselves during their numerous trials, have proved sources of much trouble to the officials in charge of their fitting out. The career of the *Barracouta* especially has been, so far, anything but a successful one. If the original intentions of the authorities at Whitehall could have been carried out, she would have been ready for the pennant in March last; as it is, however, she has just passed through her eight hours' natural draught trial—after having made five previous attempts to accomplish this end—and is still in the hands of the dockyard employés at Sheerness. The government contract with the Palmer Shipbuilding Co. was to the effect that the engines should attain 1,900 H.P. under natural draught during an eight hours continuous run, and this was successfully achieved on Friday, the 9th ult., when a mean H.P. of 1,920 was registered, although the speed attained was about two knots less than the estimated mean speed for the natural draught trial. The *Barracouta* is a sheathed cruiser 220 ft. in length between perpendiculars; 35 ft. in breadth, with a displacement of 1,580 tons in a mean draught of water of 14 ft. She is fitted with twin-screw triple-expansion engines, having cylinders of 21 in., 31 in., and 45 in. in diameter respectively by 24 in. stroke, and designed to develop 1,900 I.H.P., with natural draught, and 3,000 I.H.P., with forced draught. Two cylindrical double-ended boilers are placed in separate watertight compartments, each boiler being 10 ft. 9¼ in. in diameter, and 17 ft. 6 in. in length, with a working steam pressure of 155 lbs. per square inch. The total grate surface amounts to 195 square feet, and the total heating surface to 5,230 square feet. The *Barracouta* left harbour for the first trial of her machinery on the 30th January, 1890, but a defect in the steering engine caused the trial to be postponed until February 6th, upon which occasion a joint in the high-pressure cylinder leaked, and necessitated a delay of another day. On the 7th February, after having been under steam for three-quarters of an hour, a lamentable calamity occurred through a rush of gas and flame from the ash pits of the port boiler, which resulted in the death of two men and serious injuries to nine others. The fourth attempt at a trial was made in December last, when a heavy snowstorm compelled a return to harbour. The fifth essay was made on the 23rd of the same month, when the boilers primed badly, while the sixth effort, which was attended with success, took place on the date previously alluded to. The Admiralty authorities have decided to forego the forced-draught trials with this ship, and when her gun trials—which will take place shortly—are passed, she will be completed in readiness for commissioning without delay.

The *Blanche*—a sister vessel recently commissioned for active service in the East Indies—was recently placed in dry dock at the Devonport dockyard, when a defect of a rather serious nature was made manifest. The screw shafts of this vessel are not encased in tubes, as is the customary manner with twin-screw ships, but are covered with a metal sheathing secured to the shafts in lengths of about 4 feet. At each of the joints of this metal covering, the water seems to have penetrated and set up corrosion to an alarming extent. Both shafts will require to be rigidly examined by removing the metal skin, and this will delay the departure of the *Blanche* for her station at least six weeks. The *Blanche* was launched from Pembroke dockyard in 1889, and was engined by Messrs. Earle & Co., Hull. In March of last year she went on an eight hours' natural-draught trial when the following results were obtained:—Speed, 14·75 knots; I.H.P., 1832; and revolutions, 167·8. Twice during the same month attempts at a forced draught trial were made, but had to be abandoned on account of leaky boiler tubes. The *Barracouta* type were designed to realise a maximum speed of 16·5 knots.

New Fast Cruisers.

The authorities at Sheerness dockyard have received orders from the Admiralty for a new second-class cruiser to be commenced during the next financial year and to be named the *Charybdis*. The plans for this vessel are arranged from designs by Mr. W. H. White, Director of Naval Construction, and embody all the latest improvements necessary to meet the requirements of modern warfare. Practically speaking the *Charybdis* will be an enlarged *Andromache* and built on similar lines. She will have a length of 320 ft., a breadth of 47 ft., with a displacement of 4,360 tons, and will be fitted with triple-expansion engines capable of developing 9,000 H.P., which is estimated to propel her at a speed of 20 knots. As at present arranged the armament will be of the most powerful description, consisting of two 6-inch breech-loading guns, to be mounted, one each on the poop and forecastle respectively; eight 4·7-inch guns mounted four on each broadside; and nine 3-pounder and 6-pounder quick-firing guns. The vital parts will be covered by a steel deck 2 in. thick ranging from stern to stern, while a breastwork 5 in. thick will be fitted in wake of the machinery and affording protection to the cylinders. The *Charybdis* will be the largest vessel ever constructed at Sheerness.

At Chatham dockyard preparations are being made for the construction of a new second-class cruiser of 3,600 tons displacement, to be named the *Forte*. In many respects the *Forte* will resemble the *Apollo*, now almost ready for launching at the same establishment. She will have a length of 300 ft., a breadth of 43 ft., and a mean draught of water of 22 ft. 9 in. when fully equipped. The estimated speed under forced draught is 20 knots with 9,000 H.P. The armament will comprise two 6 in. and six 4·7 in. breech-loading guns, and 12 quick-firing machine guns.

A second-class armoured cruiser for the French Navy is to be commenced at Rochefort during the current year, and will be similar to the *Charner*, now under course of construction at that port. The new vessel is to be named the *Bruix*, and will be of the following dimensions:—Length between perpendiculars 348 ft., breadth, 46 ft., mean draught of water 19·2 ft., and displacement 4,670 tons. Twin-screw triple-expansion machinery will be provided, capable of developing 7,300 I.H.P. under natural draught, and 8,200 with a moderate allowance of forced draught. Two 7·5 in. and six 5·5 in. breech-loading guns, carried in barbette towers, will constitute the main armament.

In addition there will be mounted four 2·5 in., and four 47 mm. quick-firing guns, besides five torpedo tubes, two forward, one on each broadside, and one at the stern. Two pole masts are to be fitted with military tops for the use of machine guns.

Battleship Construction in the Royal Dockyards.

Work in connection with the construction of the new battleships, building under the Naval Defence Act goes on apace. The *Renown*, first-class battleship, building at Pembroke, has just had her athwartship armour placed in position and secured, and is otherwise so far advanced that already preparations for her launch are being talked of. The *Hood*, at Chatham, a turreted battleship of 14,150 tons displacement, is advancing by leaps and bounds, and at the present rate of construction will be ready to take the water in June. The *Barfleur*, the first of the second-class battleships is growing so rapidly, that there is every prospect of her being completed and ready for sea well within the specified time of three years. The first-class barbette battleship *Royal Sovereign* is so near completion that she is destined to be floated out of No. 13 Dock at Portsmouth, on the 26th inst., when the christening ceremony will be performed by Her Majesty. The *Royal Sovereign* has been built in a remarkably short period of time; her first keel plate having been laid on the last day of September, 1889. Her dimensions are as follows.—Length, 380 ft.; breadth, 75 ft.; draught of water, 27 ft. 5 in.; and displacement, 14,150 tons. She far exceeds in weight any ship hitherto constructed for the Navy, and will surpass in auxiliary armament and speed all other armourclads. She is protected at the water line by an armour belt 8½ ft. in breadth, extending over two-thirds of her length, and having a maximum thickness of 18 in. This belt is terminated by armoured bulkheads, while the broadside above the belt is protected to a height of 9½ ft. above water, over a considerable portion of her length, by armour 5 in. thick. The armour on the barbettes is 17 in. thick. As at present arranged the armament of the *Royal Sovereign* will comprise four 13·5 in. 67-ton breech-loading guns, ten 6 in. 5-ton quick-firing guns, 16 16-pounder and eight 3-pounder quick-firing guns, together with seven torpedo tubes, two of which are submerged. The propelling machinery is estimated to develop 13,000 H.P. under forced draught, and 9,000 with natural draught, from which speeds of 16 knots and 17½ knots respectively are expected. The coal capacity amounts to 900 tons and will enable the vessel to steam a radius of 5,000 knots, at a reduced speed of 10 knots, and from 1,500 to 2,000 knots at her maximum speed. According to the official programme the *Royal Sovereign* is to be completed by December, 1893.

Engine Building at Chatham and Sheerness

The officials of the engineering department at Sheerness dockyard are certainly to be complimented on the highly successful results attained at the eight hours natural draught trial of the first-class torpedo gunboat *Gossamer*, after the many unsuccessful trials and numerous failures experienced with other vessels of this class—particularly the *Sharpshooter*—engined by private firms. The machinery of the *Gossamer* was constructed entirely at Sheerness, and is the first turned out from that dockyard. The preliminary trials, as well as the final eight hours trial of the *Gossamer*, have been carried through without the slightest hitch, and on the latter occasion the mean H.P. realised was 2,618, being 118 in excess of the power stipulated in the specification. The trials of the *Gossamer* have so well satisfied the Admiralty officials, that a duplicate set of her machinery for a similar vessel is to be entrusted to the engineering staff at Sheerness

Up to the present time the propelling machinery of all vessels built at Chatham has been supplied by private firms, but the Admiralty have decided to make a new departure in the case of the second-class cruiser *Forte*, which is shortly to be commenced at that establishment, and have her machinery made in the dockyard. The two sets of engines are to be of the triple-expansion type and will be capable of developing collectively upwards of 9,000 I.H.P.

Institution of Naval Architects.—We have had the following resolution adopted by the Council of this Institution communicated to us:—"Resolved—That the Council will be willing to present a gold medal to any Member or Associate of the Institution, not being a Member of Council, who shall at the forthcoming spring meetings read a paper which, in the judgment of the Council, shall be deemed to be of exceptional merit." The ordinary dates for the annual meetings will this year fall on the 18th, 19th, and 20th March next.

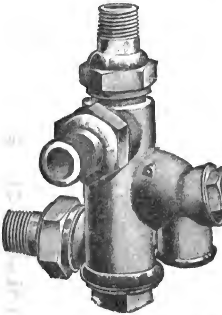
THE HYDRAULIC APPLIANCES SHIPBUILDING CO., LIMITED.

A COMPANY constituted under the above title is now in course of formation, for the purpose of acquiring proprietorial rights in certain patents brought out by Messrs. A. C. Holzapfel, of 57, Fenchurch Street, and F. C. Goodall, Naval Architect of the Trinity House. The patents consist of one by Mr. Holzapfel, for a new method of building ships or other plated structures out of plates flanged on all four sides, and for riveting the flanges together by hydraulic machinery, and another by the same inventor for a flanging machine which not only flanges the plate at one pressure, but shapes it for its special place in the structure at the same time. A third patent has been obtained for a "tube rivet," which is intended to be used in substitution of the drain-holes which, in ordinary cellular-bottomed ships, are punched in the floorplates to permit a free passage of water from cell to cell. This contrivance, which is the invention of Mr. Goodall, effectually meets a difficulty that had to be provided for, and forms an important feature in the new system. The method of proceeding with the construction of a vessel under this system is first to prepare the plates for their positions in the structure, by flanging and shaping, which is all the preparation they require, and afterwards to clamp them together temporarily, one or two strakes at a time, with a view to have them punched and riveted in their places by hydraulic pressure. As the flanges even in the largest ships will not exceed 9 in. (4½ in. being about the minimum width), only a 9-in. gap is required in the punching and riveting machines. These are consequently extremely light, so much so, that either can be worked by one man, as the machines will travel along the ship on conveniently placed rails. No countersinking will be required, as the rivets, of which there will probably be three tiers in each flange, will be "headed" on both sides. In ordinary shipbuilding it is always an element of cheapness to have more than one vessel built off the same lines, but under this new system the advantage of duplicate building will be much enhanced, as a careful design for each plate to be used in the construction of a vessel must necessarily be prepared, and it is therefore in the highest degree desirable that as many plates as possible should be made of the same shape and size. This system has got so far on the way to success that a vessel to be built in accordance with its principles is now in course of construction. This is a Thames lighter which is to be built of plates, all of which are of equal dimensions, namely, 2 ft. 4 in. wide by 4 ft. 8 in. long. It will be noticed that the arrangement of these plates in their places will provide a series of continuous flanges running longitudinally at distances of 2 ft. 4 in. from each other, from end to end of the vessel, besides which there will be a flange running transversely for every plate employed, both lines of flanges being twice as thick as the plating. In larger vessels the plates to be used may be somewhat wider, but in no case will the width of 3 ft. be exceeded, so that in connection with the plating an internal framework of great strength will always be provided. In vessels of the largest class, it is contemplated to use web frames at distances of from 9 to 12 feet, and where these are introduced a small amount of surface rivetting will be necessary. The practical reader will have already observed that in the smaller vessels where no web frames are used surface or shell rivetting will be entirely dispensed with, and it may be here remarked that by this system the problem of connecting the shell plates together by machine rivetting appears to have found a satisfactory solution. The inventor of the system, who has for a long time given his close attention to the subject, being intent on perfecting all matters of detail, has at last been successful in devising a method for applying it to almost all classes and sizes of ships, and to all interior parts, such as decks, bulkheads, &c. By its use a saving of from 80 to 90 per cent. in labour is estimated to be effected, and the inventor expresses the greatest confidence in its ultimate general adoption and complete success. The time is certainly opportune for the launching of such a project, as owing to the present dearth of orders, shipbuilders are likely soon to have leisure for the introduction of new arrangements in their yards. Whatever may be its intrinsic worth—and this of course has yet to be proved by actual results—it appears to possess one advantage, which should commend it to the notice of employers, and that is that it will (if successful render them practically independent of the most restive classes of workmen with whom they have to deal. It may be added that wherever this system is introduced there will be little need for shearing or punching machines, and indeed excepting where very large vessels are to be built, the ordinary paraphernalia of a shipyard may be dispensed with. There will be no need for frame furnaces, plate rolls, or keel-plate benders and as it has been already indicated that there will be no work for counter-sinking machines, it would seem that the work of any shipyard in which this system is adopted may be carried on with as small an amount of plant as was found necessary in the days of wood shipbuilding In respect of the tube rivet already mentioned, it should be stated. that a special tool for turning over the ends has been provided, and when the ends of the rivet have been pressed home by the hydraulic rivetter, an opening through its centre of about 2 in. diameter for the free passage of water will remain. The capital of the Company now being formed in connection with the promotion of this new method of shipbuilding will be in the first instance only £20,000, and the price to be paid for the three patents referred to is fixed at £10,000, in fully paid-up shares, no cash payment being required. Mr. A. C. Holzapfel is to be general manager of the Company, which, along with its other functions, will exercise the right to grant letters of license to such shipbuilders as may express a desire to adopt the system. Wherever any attempt at an expression of opinion occurs in this notice, it is, perhaps, as well to state that the intention is merely to indicate the views on the matter that are held by gentlemen who are directly interested in the success of the system. It is never wise to express an opinion of a system which has not been tried by the test of experience, and especially is this the case in reference to an idea which if found capable of practical application, is bound to revolutionise a great industry. We are glad, however, to be able to lay the foregoing details before our readers, and we feel sure that many points worthy of attentive consideration will be found in them.

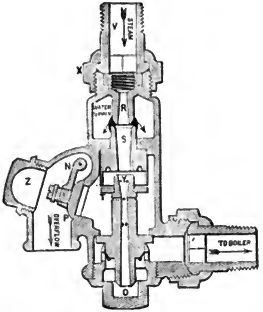
THE PENBERTHY AUTOMATIC INJECTOR.

THIS Injector, is now being adopted as a successful injector for marine boilers, and as it presents some features not to be found in some of those now in use, it may not be amiss to give a short description of it.

Our illustrations show a perspective view and a sectional one. From the latter it will be seen that all the jets are easily removable, and can be so removed and replaced by even an inexperienced person. V is the tail pipe, X, tail nut, R, steam jet, S, suction jet, Y, delivery tube, N, overflow hinge, Z, overflow cap, P, overflow valve, T, ring, and O, plug.



All these parts are made to gauge, and therefore no difficulty need be experienced in repairs. It is simple and easy to work, requiring no delicate adjustment of valves, and when properly fixed it starts automatically when the steam and water are turned on. It lifts from 18 to 20 feet, and will also take a supply from a head without change of jets, and works from 20 lbs. to 25 lbs. low, to 130 lbs. to 150 lbs. high, steam pressure, according to lift.



The injector is absolutely AUTOMATIC and RE-STARTING. If the water supply is broken from any cause, such as a sudden shock, or air getting into the suction pipe, it will re-start without any attention.

We quote from a report of a test which speaks for itself:—

"A size B was tested, which not only worked most easily—being perfectly automatic within a wide range—but also with a high degree of economy. Forcing against a constant pressure of 65 lbs., and with steam pressure varying from 45 lbs. to 90 lbs. *The proportion of water forced to steam used rises steadily,* while the duty or work, and the efficiency as a boiler feeder undulate. Its efficiency of 99½ per cent. is quite a phenomenal result, being within a half per cent. of efficiency."

The "Penberthy" can be cut down to one-half its tabulated capacity, and this grading quality gives it a great advantage, as the supply can be so regulated that the water gauge can be kept at a uniform height, and it is suggested that by having an injector of larger capacity than required on a boiler, and cutting down supply, the water can be delivered at a very high temperature. It is also claimed that this injector is about the only one in the market that will work with a hot suction pipe.

We understand that over 38,000 of them have already been sold, and we have seen a testimonial from a yacht owner who has one of them fitted to his boiler, in which he says, "It is one of the best boiler feeders I have seen, as, if properly mounted, nothing short of foul play can stop it in working."

Messrs. Pontifex & Wood, Limited, Farringdon Works, Shoe Lane, London, are the makers.

LLOYD'S REGISTER SHIPBUILDING RETURNS.

For the Quarter ended Dec. 31, 1890.

FROM the Returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 471 vessels of 734,010 tons gross under construction in the United Kingdom at the close of the quarter ended 31st Dec., 1890. The particulars of the vessels in question are as follows, similar details being given for the corresponding period in 1889 for the purpose of comparison:—

Description.	Dec. 31, 1890.		Dec. 31, 1889.	
	No.	Gross Tonnage.	No.	Gross Tonnage.
Steam.				
Steel	301	601,583	384	753,209
Iron	63	17,721	51	30,321
Wood and Composite ..	4	1,120	3	1,000
Total	368	620,424	438	784,530
Sail.				
Steel	62	105,228	45	78,283
Iron	7	4,820	6	7,700
Wood and Composite ..	34	3,538	32	2,444
Total	103	113,586	83	88,427
Total Steam and Sail ..	471	734,010	521	872,957

From the above statement it will be observed that the merchant tonnage under construction in the United Kingdom at the end of 1890, was nearly 16 per cent. less than the tonnage under construction at the end of 1889. The lowest point, however, was reached in the returns for the third quarter of the year, which gave a total of 406 vessels of 652,248 tons under construction, and the present returns give evidence of some reaction. The returns of vessels for the construction of which preparations are now being made, point to a similar conclusion—178 vessels of 293,288 being reported as preparing at the present time, against 136 vessels of 242,091 tons at the close of the previous quarter.

It may be added that, of the tonnage under construction in the United Kingdom at the end of December, excluding that being built for foreign owners, nearly 95 per cent. was under the supervision of the surveyors of Lloyd's Register with a view to classification by this society. Of the tonnage being built for foreign owners over 76 per cent., and of the total tonnage under construction in the United Kingdom, nearly 90 per cent. was under the society's supervision.

The following details concerning the vessels included in the foregoing statement are necessary in order to represent properly the shipbuilding work of the past three months.

During Quarter ended Dec. 31, 1890.	Steam.		Sail.	
	No.	Gross Tonnage.	No.	Gross Tonnage.
Vessels commenced ..	181	282,896	41	58,372
Vessels previously commenced but not progressed with	7	650	5	585
Vessels launched	147	241,518	22	36,208

It may be noted here that during the year 1890 there were launched in the United Kingdom 651 steamers, of 1,061,619 tons, and 92 sailing vessels of 133,086 tons, or a total of 743 vessels of 1,194,705 tons.

It will doubtless be of interest to give the total figures for vessels now under construction at the principal shipbuilding centres of the country, as compared with those for the same period last year:—

District.	Description.	Dec. 31, 1890.		Dec. 31, 1889.	
		No.	Gross Tonnage.	No.	Gross Tonnage.
Belfast and Londonderry	Steam..	21	64,170	20	62,745
	Sail ..	6	6,487	6	7,432
	Total ..	27	70,657	26	70,177
Clyde	Steam.	81	133,931	124	225,121
	Sail ..	33	55,516	27	49,111
	Total ..	114	189,447	151	274,232
Mersey	Steam..	17	11,945	11	10,320
	Sail ..	5	6,900	7	9,120
	Total ..	22	18,845	18	19,440
Tees	Steam..	50	124,592	56	108,261
	Sail ..	—	—	1	2,360
	Total ..	50	124,592	57	110,621
Tyne	Steam..	66	130,772	73	157,033
	Sail ..	—	—	1	150
	Total ..	66	130,772	74	157,183
Wear	Steam..	41	90,575	63	141,399
	Sail	6	10,910	1	1,390
	Total ..	47	101,485	64	142,789

Lloyd's Register of Shipping,
2, White Lion Court, Cornhill, E.C., Jan., 1891.

THE COOPER AND WIGZELL SEA-SOUNDING INSTRUMENT.

IN our issue for last month we called attention to this instrument. We are now enabled to give a detailed description of it, and we refer our readers to the illustration which accompanied last month's article.

The apparatus consists of the sounder (with outer case), the sinker, winch, special wire, and fair-lead. The sounder is a simple mechanism actuated by hydrostatic pressure; on it is a graduated scale of depths, past which a pointer or indicator moves, and by means of which the greatest depth of water attained by the instrument during the cast is read off. This pointer is so constructed that its position cannot be altered by any shock or blow. After it is hove up, the sounder is drawn from its protecting case, in order to read the depth. This protecting case is attached to the wire a fathom above the sinker, and can be fixed on or taken off the cable in a few seconds by means of patent attachments, there being no lashing required. The sinker weighs about 35 lbs., and is furnished with a hollow at its bottom end for arming with tallow—which should be put in, in a concave form, so that it will not project.

The winch is fitted with a good brake and a barrel which runs freely. It is powerful enough to enable two men to heave in the sounder smartly. The brake will stop the cable running out at any time, and has it well under control.

The winch is so constructed that when not in use it may be closed up inside the box upon which it is fitted, making the whole thing very compact.

The patent cable is constructed of galvanized steel wires braided with hemp, specially made to prevent kinking or tangling, and will bear a strain of nearly half-a-ton, so that there is no fear of losing the instrument.

The depth recorded is absolutely according to the hydrostatic pressure due to the vertical height of water over the sounder at the time. If there is a swell or high sea running, the figures will indicate, in most instances, the depth from the top of the wave. So absolutely certain are the depths recorded, that they are in no way affected by the speed of the ship or by drift, or the amount of line run out through tide or current, nor by height of barometer, nor by variation of temperature. In passenger vessels, the facility with which soundings can be taken with this apparatus prevents passengers from becoming alarmed at the stoppage of the vessel at sea, while to sailing vessels it is a great boon, as there is no necessity to heave-to for soundings, and the ship may stand on until a certain depth is struck, a great saving of labour for all hands.

LANGFORD'S IMPROVED MARINE GLUES.

THESE glues are the manufacture of Messers. Langford & Son, Landport, Portsmouth, and while they are somewhat similar to those of other makers, yet they possess some distinguishing features. By 25 years' experience which their principal (who has joined them in this department), has had, they have been able to introduce some improvements in the manufacture which enable them, we believe, to put the glues on the market at a somewhat lower rate. Their No. 1, or caulking marine glue, is of an elastic, tenacious nature, and is used for paying decks, topsides, bottoms, &c., of yachts and ships. It is tempered to a consistence that enables it to withstand the extreme of climates, without losing its effectiveness, and will not crack or start from the seams in cold weather, or run and adhere to the feet in hot climates No. 2, or sheathing glue, is of the same elastic, tenaceous nature, but is tempered somewhat softer, and adapted for jointing between the iron and woodwork of composite-built ships, and all other similar purposes, rendering the joint perfectly watertight, and at the same time preserving the iron by preventing oxidation. Although shipbuilders would not now think of using anything but marine glue for paying vessels, decks, still there are many purposes for which it is equally well adapted, where it is not at present used. For instance, in all cases where pitch is used in shipbuilding, marine glue would be much more effective, and jointings of wood, iron, or other substances can by it be made perfectly watertight. This effectiveness over other materials is owing to the fact that while it is very tenacious and bites or adheres to any substance to which it is applied, it is at the same time of so elastic a nature that when the joints close or open through the effects of varying climates, the glue stretches or contracts accordingly, without breaking the joints. We understand that these glues are in extensive use, and from the merits they undoubtedly possess, a still further extension in that direction no doubt awaits them.

A LARGE SAILING VESSEL.—The American four-masted clipper ship *Shenandoah*, of Bath, Maine, is, as far as we know, the largest wooden sailing ship in existence. She is nearly three times as big as the Yankee record of thirty years ago. The *Dreadnought*, which made the fastest voyage of any sailing vessel to Liverpool, measured only 1,200 tons. The *Shenandoah* measures 3,409 tons gross and 3,258 tons net. She is 325 ft. long over all, 308 ft. on the water line, 49 ft. wide, and 29 ft. deep. She draws 27 ft., or about as much as the *City of Paris*. Her carrying capacity is 5,000 tons, or more than some of the largest freight steamships. She has a steel bowsprit, weighing 13 tons, and no jibboom. She is constructed of oak, and was launched from the yard of Messrs. Arthur Sewell & Co., Bath, in November last.

MASON'S SIDELIGHTS AND SKYLIGHTS.—On page 449 of our last issue it was stated in describing the s.s. *Cornhill*, "In the engine-room seven of Mason's patent skylights have been fitted; *in the saloon twelve skylights*." The words in italics should have been "In the saloon skylight twelve of Mason's patent pivoted sidelights were fitted," and several have been adopted elsewhere in the vessel. The skylights have already been described in our pages, and at an early date we hope to illustrate and describe the sidelights.

PURVES' RIBBED FLUES ADOPTED BY THE BRITISH ADMIRALTY.—In the boilers of H.M.S. *Sybille*, which vessel was recently launched from the yard of Messrs. Robert Stephenson & Co., Limited, "Purves'" patent ribbed flues have been adopted—a speciality now so well-known to our readers as to require no further description.

VESSELS AT BERGEN.—The steamer fleet of Bergen, in Norway, has during the year 1890 been increased with twenty-four steamers of an aggregate tonnage of 20,615 tons, and an aggregate value of 6,450,000 kr. Bergen has now altogether 179 steamers with an aggregate tonnage of 126,748 tons. At the end of 1890 there were in the course of building for Bergen account seventeen steamers with an aggregate tonnage of 19,728 tons, and value 4,750,000 kr.

FAST STEAMING BETWEEN QUEENSTOWN AND LIVERPOOL.—The Cunard steamer *Umbria*, which left Queenstown at 2.5 a.m. on Saturday, January 10th, after a smart passage of 6 days 6 hours and 59 minutes across the Atlantic against easterly winds, made a smart run to Liverpool to "catch the tide" at the bar. The tide at Liverpool was at 11.23 in the morning, and of course much earlier at the bar. As at this season of the year especially, and with frequent fogs, it would be most inconvenient for passengers to lie waiting an indefinite time at the bar, advantage was taken of the clear weather to steam the *Umbria* at her best, and not only was the bar crossed, but with time to spare, the run from Queenstown occupying only 10 hours and 40 minutes, and passengers were enabled to leave by the afternoon train, and were set down in Euston Station, London, in seven days two hours from passing Sandy Hook lightship.

THE NEW GRAVING DOCK AT BOMBAY.—The *Times of India* describes the new graving dock at Bombay, which is to be ready for use next month. The dimensions are as follows:—Length of floor, 500 ft.; extreme length available for docking purposes, 530 ft.; width at coping, 90 ft.; width at floor, 62 ft.; depth of dock at head, 33 ft.; depth of stern, 34 ft.; available depth for docking at H.W.O.S.T., 27 ft. 3 in.; width of entrance, 65 ft. 6 in., the sill of the entrance, as well as the dock, having been determined at an extra low level in order to accommodate ships of the Royal Navy of the second class, such as the *Warspite* and the *Imperieuse*. The work is very substantial, no less than 140,000 cubic feet of dressed stone and 32,000 cubic yards of rubble masonry having been utilized in the construction. The whole of the masonry is of rubble, faced with ashlar, the stone used being the ordinary basalt, found in the Island of Bombay, while the facing is of a similar description to that used in the retaining walls of the Prince's and Victoria Docks. The stone used for forming the grooves in which the caisson is to be placed is Cornish granite, taken from England for the purpose. The work involved 95,000 cubic yards of excavation, composed of clay, moorum, and rock. As is usual in India, all the excavation was done by hand, the surplus material that was not required for the construction of the dock being taken to Tank Bunder, where it has been used for reclamation purposes. The dock at H.W.S.T. will hold about 7,000,000 gallons of water, which will be filled through the culverts placed on either side of the entrance to the dock, and with three powerful 36 in. centrifugal pumps it will be possible to empty it within three hours. The whole undertaking will be completed within the total estimated cost of Rs.11,44,850.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from December 23rd, 1890, to January 24th, 1891.

Barber, James H. (probationary), assistant engineer to the *Camperdown*, to date January 6th.

Bell, Laurence, engineer to the *Indus*, to date January 27th.

Bramsdon, Wm. H., chief engineer to the *Warspite*, to date March 7th.

Cook, Wm., chief engineer to the *Asia*, additional for the *Naiad*, to date December 31st.

Coomber, Thos. A., chief engineer to the *Pembroke*, additional for the *Thetis*, to date December 31st.

Colquhoun, Peter, fleet engineer to the *Inflexible*, to date January 20th.

Couper, Ivie A., staff engineer to the *Impérieuse*, to date January 27th.

Crowley, Edward A., engineer to the *Boadicea*, to date January 24th.

Daves, Henry T., assistant engineer to the *Imperieux*, undated.

Dawson, Thos. J. (probationary), assistant engineer to the *Tauranga*, undated.

Deacon, Alfred E. C., engineer to the *Conqueror*, to date January 27th.

Fleetwood, John L., engineer to the *Vernon*, additional, to date January 19th.

Fussell, John S., engineer to the *Skipjack*, to date January 27th.

Galpin, Joseph R., engineer to the *Orontes*, to date January 27th.

Galpin, Thos. R., engineer to the *Asia*, as supernumerary, to date December 31st.

Gibbs, Alfred W., engineer to the *Urgent*, additional, to date January 19th.

Harvey, Wm. A., fleet engineer to the *Belleisle*, to date December 31st.

Hellyer, Fredk. A., engineer to the *Redpole*, to date January 20th.

Jenkin, John H., assistant engineer to the *Ringarooma*, undated.

Jenkins, John E., engineer to the *Penelope*, additional, to date January 15th.

Johnson, John R. D., chief engineer to the *Ringarooma*, undated.

Juniper, Wm. V., engineer to the *Asia*, additional, to date January 15th.

Larg, James C., chief engineer to the *Amphion*, to date January 5th.

Lewis, Benjamin J., engineer to the *Research*, to date January 27th.

Magg, Wm. G., engineer to the *Linnet*, to date January 27th.

Markby, Edward J., engineer to the *Tauranga*, undated.

May, Walter, engineer to the *Pembroke*, additional for the *Tartar*, to date January 21st.

Morris, George H., assistant engineer to the *Imperieux*, to date January 27th.

Page, Walter H. (probationary), assistant engineer to the *Tauranga*, undated.

Puxoe, George, engineer to the *Pallas*, to date January 15th.

Rolle, Absalom R., assistant engineer to the *Victor Emanuel*, to date January 27th.

Royes, James A., assistant engineer to the *Tauranga*, undated.

Saunders, Wm. C., assistant engineer to the *Impérieux*, to date January 27th.

Shorey, Chas. E., engineer to the *Ringarooma*, undated.

Short, Edward A., engineer to the *Indus*, additional, to date January 27th.

Simmons, Geo. T., chief engineer to the *Pembroke*, additional for the *Medea*, to date January 5th.

Sparkes, Hy. P., assistant engineer to the *Porpoise*, to date January 27th.

Spray, Fredk. M. D., engineer to the *Impérieuse*, to date January 27th.

Stuart, James J., chief engineer to the *Tauranga*, undated.

Stuart, Marlin, engineer to the *Indus*, to date January 17th.

Taylor, Chas. G., engineer to the *Impériuse*, to date January 27th.

Tregenna, Hy. E., assistant engineer to the *Victor Emanuel*, to date January 27th.

Vincent, Wm., fleet engineer to the *Asia*, additional, to date January 20th.

Watkins, Ben. J., engineer to the *Porpoise*, to date January 27th.

Wise, Fredk., engineer to the *Firebrand*, additional, to date January 27th.

HOAR & BROWN'S ANNUAL HARDWOOD MARKET REPORT, December 31st, 1890.

TEAK.—	Timber. Loads.	Planks. Loads.	Blocks. Loads.	Total. Loads.
Stock, 1st January, 1890...	7,817	1,779	51	9,647
Landings for the year ...	12,884	2,695	98	15,677
	20,701	4,474	149	25,324
Deliveries for the year ...	13,563	3,259	113	16,935
Stock, 31st December, 1890	7,138	1,215	36	8,389

Analysis of Landings, Deliveries, and Stock of Timber:—

	Moulmein. Loads.	Rangoon. Loads	Bangkok. Loads.	Total. Loads.
Stock, 1st January, 1890 ...	2,705	4,505	607	7,817
Landings for the year ...	4,361	2,975	5,548	12,884
	7,066	7,480	6,155	20,701
Deliveries for the year...	4,609	4,885	4,069	13,563
Stock, 31st December, 1890	2,457	2,595	2,086	7,138

The above figures show that, as compared with 1889, the imports were 18 per cent. less and the deliveries 7 per cent. in excess, leaving a smaller stock on hand by 13 per cent. Throughout the year there has been a steady decline in prices, which we hope has now touched bottom. The tonnage afloat is 18,826 tons, as compared with 32,678 tons at the close of 1889. The heavy stocks of low class wood, which formed the greater part of the stock at the end of 1889, have been further increased by the inferior imports during the season from Bangkok, adding materially to the depressed condition of the market, and, until these are entirely cleared off, no improvement in prices may be looked for. The imports from Burmah were of a most satisfactory character, and went readily into consumption. If shippers continue the wise policy of restricting shipments, which has been pursued for some time past, there can be little doubt that the present position, which indicates firmness, will be considerably strengthened, and, as the season advances, values may once again exhibit an upward tendency. Bangkok shipments will have to improve very materially indeed before they can possibly compete with, or influence the price of Burmah wood. A steady increase is shown in the consumption of planks, with very little fluctuation in values. The Admiralty requirements for 5,000 loads have been arranged for, and this reduction from floating Burmah stock, which is reported to be unusually small, will further help to strengthen the market.

MAHOGANY (HONDURAS & TOBASCO).—Following on the gradual rise in 1889, the market prices have continued to improve steadily, especially for sizeable timber, the small and inferior qualities dragging behind, leaving a wide difference in values. Lately, however, the demand for smaller classes has increased, putting it upon a fair footing with the larger sizes, and, having in view the extensive orders which are contracted for, the outlook, carrying far away into the new year, is extremely encouraging.

CUBA AND ST. DOMINGO had a very quiet and unsatisfactory time until the latter months, when a reaction occurred, partly by large orders coming in for very considerable quantities. Although the imports were very heavy, the quantity of sizeable logs was not sufficient to meet the demand, which continues very brisk, and early arrivals will meet a good market.

The Dock returns of the landings, deliveries, and stocks during the last two years are as follows:—

		LANDINGS.	DELIVERIES.	LANDED STOCK. 31st December.
Honduras.	1889...	9,069 logs.	7,530 logs.	2,301 logs.
,,	1890...	11,521 ,,	10,894 ,,	2,928 ,,
Mexican, &c.,	1889 ..	7,648 ,,	8,486 ,,	1,970 ,,
,,	1890...	7,001 ,,	7,645 ,,	1,326 ,,
Cuba,	1889...	8,029 ,,	9,178 ,,	1,391 ,,
,,	1890 ..	12,650 ,,	11,479 ,,	2,562 ,,
St. Domingo,	1889...	1,086 ,,	1,011 ,,	117 ,,
		Logs and curls.	Logs and curls.	Logs and curls.
,,	1890...	9,085	5,966	3,236

KAURI PINE.—Planks have met with a better result than logs, although present prices cannot pay shippers. During the year forced sales have taken place to push the wood into consumption, but only hand-to-mouth buyers have been found and the trade has fallen very flat.

American Whitewood.—There has been a fair business in logs of good quality, and high figures have been obtained, but small and inferior wood was only saleable at low figures. Planks and boards have sold freely, and, there being a heavy importation, prices have remained fairly firm and are expected to continue so.

Sequoia.—The stocks cleared off at the "Without Reserve" sale during the early part of the season have been replaced by another cargo, but the demand has proved very limited, giving little encouragement to shippers for future speculations.

Satin Walnut.—There appears to have been an extensive trade both in boards and logs, and the low prices give consumers every opportunity of introducing the wood for cabinet-making purposes.

Padouk.—The present reduced cost should render this timber available for many new purposes, and the recent forced sales will do much to direct the attention of the trade to its useful qualities.

Oak (American Quartered).—Importations have been large, and an extensive trade has been done throughout the year at remunerative prices. All old stock has been cleared from this market, leaving only a few recently imported parcels in first hands. There is a great scarcity of dry goods which would readily sell. We look for an increased trade at higher figures.

Cedar.—Shipments were heavier than in 1889, but the consumption has been large, leaving very little in first hands. Early in the year enquiries were dull and stocks hung on hand, but later an improvement took place, and better prices are now expected to rule.

The landings, &c., during the last two years have been:—

		Landings.	Deliveries.	Landed Stock. 31st December.
Cuba,	1889	... 2,200 logs.	... 1,341 logs.	... 1,832 logs.
"	1890	... 2,948 "	... 2,928 "	... 1,852 "
Honduras, &c.,	1889	... 1,131 "	... 1,579 "	... 765 "
"	1890	... 594 "	... 1,010 "	... 349 "
Pencil,	1889	... 7,484 "	... 5,241 "	... 3,248 "
"	1890	... 8,626 "	... 3,531 "	... 8,343 "

American Walnut.—The trade has been very considerable both in cut stuff and logs. Prices have ruled firm for prime quality, and would have been still higher but for the large importations of inferior grades, which, though really not in competition with the better class wood, caused very low quotations to be made in the market, giving a false impression as to values generally. It is satisfactory to know that the greater portion of the rough quality of boards has been cleared, though at prices which must have left a loss to shippers, but there is still a large quantity of rough logs on hand. Frequent enquiries are received both for prime board and log, and there is a good market.

The landings, &c., for the last two years have been:—

	Landings.	Deliveries.	Landed Stock. 31st December.
1889	... 3,370 logs.	... 5,675 logs.	... 557 logs.
1890	... 4,761 "	... 4,262 "	... 1,056 "

Canadian Hardwoods.—The supply, although limited, has been quite sufficient for the requirements of the trade. Imports during the year were:—

Elm, 1,400 loads, as against 4,500 loads in 1889.
Oak, 2,300 " " 4,800 " "
Ash, 2,500 " " 7,000 " "

Prices remained firm, enquiries were inactive. With regard to ash, quotations have shown wide fluctuations, the demand being very unreliable.

Yellow Pine.—2,600 loads were landed as against 3,200 loads last year. The market has been firm for better qualities, but lower grades are difficult to sell.

Greenheart.—There was only one small parcel landed, and quickly disposed of in consequence of the bareness of the market. The stock is now reduced to 18 loads. Enquiries have been very quiet, but a fresh importation would, no doubt, stimulate business, as at the present time it is almost impossible to make quotations.

During the past year the hardwood business, as a whole, has been satisfactory, and the prospects for the new year may be looked upon hopefully. Stocks left on hand, being generally small and below the average of former years, any increase in the demand must necessarily cause an advance in prices.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE most unfortunate dispute which has been going on between the servants of the Railway companies having their head quarters in Glasgow and Edinburgh, and the directors and head officials of said companies—now in its sixth week—has very much disorganized business affairs generally, and many of the large industries of the West of Scotland particularly. Several shipyards and engine shops did not resume work after the holidays at the time intended, and very many such works continue to be seriously hampered for lack of coal and other necessary materials. For the same reasons the state of the steel trades and the malleable iron trade in the West of Scotland is seriously dislocated. Orders for new work in both of these departments are very scarce, and some very keen cutting has been done in prices. In the steel trade, for instance, some English makers have sold plates in Glasgow at prices which are described as simply ruinous, and which local makers say they will not accept though the alternative should be shutting their doors. The fuel difficulty stands seriously in the way, and very few of the local steel works are running full time, while at Newton and Blochairn (Steel Co. of Scotland) nothing is, at the present writing, being done. Coal prices are such that steel and iron makers are said to be contemplating a further restriction in the output of finished material.

As regards new shipbuilding and marine engine contracts booked since my last month's Notes were written, the present report might almost be summed up in the one word—*nil*. Whatever little new work there is, however, I include in the following paragraphs dealing with the amount of work the various firms have at present on hand.

The Fairfield Shipbuilding and Engineering Co., Govan, have a steamer of 5,257 tons and 3,250 H.P. pretty well forward for the North German Lloyd's line. She is to be named the *Weimer*, and is intended for the Atlantic trade. The same company are constructing the engines and boilers of H.M.S. *Hawk*, of 12,000 effective H.P. The contract is similar in every way to that of the *Edgar*, the engines for which were finished shortly before the end of the year. The company are also presently building a steamer of 1,650 tons and 1,800 H.P. for the Scottish Oriental Steamship Co.; a twin-screw steamer of 1,270 tons and 4,300 effective H.P. for the Isle of Man's Steam Packet Co.'s Channel service; a paddle steamer of 950 tons and 4,000 H.P. for the Channel trade of the Liverpool and North Western Steamship Co.; and are tripling the machinery of the *Norham Castle* and *Hawarden Castle* of the Castle Steam Packet Co's fleet.

Messrs. James & George Thomson, Clydebank, are nearly finished with the third twin-screw second-class cruiser of 3,600 tons, and 9,000 H.P. for the Government. She is similar in every way to the *Thetis* and *Terpsichore*, recently built by the same firm. This firm is also progressing rapidly with the line-of-battle ship *Ramillies*. She is the largest vessel ever ordered by the Government, her displacement in tons being 14,300. Her length is 390 ft., and breadth, 75 ft. The firm are also constructing her engines, which are expected to develop 16,000 H.P. Her armament is to consist of four 67-ton guns, ten 6-in. quick-firing guns, and 25 smaller guns. Her belt armour is 18 in. The firm are constructing two steamers of 3,000 tons each for the Brazilian Steam Navigation Co.

Messrs. Robert Napier & Sons, Govan, are building a first-class cruiser of 7,300 tons, and 12,000 H.P. for the Government. She is 360 ft. long, 60 ft. broad, and is expected to steam at the rate of 18 knots per hour. This firm is also pretty well forward with a steamer of about 6,000 tons and 7,000 effective H.P. for the Orient Line. She is the largest of the line, and when completed is expected to travel at the rate of 18½ knots per hour.

The London and Glasgow Shipbuilding Co., Govan, are progressing satisfactorily with the three wood-sheathed cruisers of the *Marathon* class, which they have on hand for the Government. The new vessels are somewhat similar to the *Magicienne* and *Marathon*, 3,000 tons burthen, and 6,000 H.P., built in 1888 by the Fairfield company.

Messrs. A. & J. Inglis, Pointhouse, are presently building a steamer of fully 6,000 tons, and 5,000 effective H.P. for the British-India Steam Navigation Co.; and are about to lay down the keel of a 40-ton cutter yacht for Prince Henry of Prussia.

Messrs. Alexander Stephen & Son, Linthouse, are building three steamers of about 4,000 tons each, and 3,500 effective H.P., for the Clan Line. They are also pretty well forward with a steamer of about 5,000 tons, and 4,000 H.P., for the State Lines Atlantic trade; and have also a sailing ship of 2,100 tons for Messrs. J. & A. Roxburgh, Glasgow.

Messrs. D. & W. Henderson, Partick, are well advanced with a screw steamer of 4,800 tons and 4,000 effective H.P., for Messrs. J. & A. Allan: and have contracted for a steamer of about 4,000 tons for the Anchor Line's Eastern trade.

Messrs. Napier, Shanks & Bell, of Yoker, are building a steamer of about 1,500 tons for the trade between the Sandwich Islands and San Francisco. She is to be engined by Messrs. Dunsmuir & Jackson, Govan.

Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, are building a twin-screw steamer, of 1,000 tons and 1,800 H.P., for Messrs. Cuirnaraes & Co., Paris; a screw steamer, of 1,300 tons and 900 H.P., for the Union Steamship Co., of New Zealand; a steam yacht of 320 tons and 1,000 H.P. to the order of Mr. James A. Allan, Glasgow; a screw steamer of 700 tons and 900 H.P. for the Canadian Government; a steam yacht of 250 tons and 450 H.P. for Mr. Peter Coats; and in addition, are making six sets of their patent quadruple-expansion type of engines for shipment to South America.

Messrs. Simons & Co., Renfrew, amongst other important work are building a four-screw hopper dredger of 700 tons for the Manchester Ship Canal Co.; and a patent hopper dredger of 500 tons for the Nicaragua Canal Co.

Messrs. James Macarthur & Co., Paisley, have secured the order for two screw steamers of 300 tons each to be built in sections for shipment for the Union Steamship Co., of British Columbia. The engines, which are expected to develop 500 H.P., are to be built by Messrs. Bow & McLachlan, of the same town.

Messrs. Alley & Maclellan, Glasgow, are building a small steamer of 25 tons and 60 H.P., to be employed in the Australian Coasting Trade; a twin-screw tug of 30 tons and 160 H.P., for towing purposes in South America; and a small steamer of 20 tons and 20 H.P., for service in the same country.

At Dumbarton Messrs. William Denny & Bros. are finishing the large and powerful mail steamer *Scot* for the Union Co.'s South African fleet, and have on the blocks a steamer of about 6,000 tons and 5,000 H.P. for the British India Steam Navigation Co.; a steamer of about 2,600 tons and 2,000 H.P. for the Union Co. of New Zealand, to be employed on the coasting trade of New Zealand, and a large paddle steamer for the Australian coasting trade to the order of Messrs. Morton & Williamson, Glasgow.

Messrs. A. Macmillan & Son, of the same town, have five vessels on order for the year 1891—two of them are pretty well forward, while Messrs. Murray Bros., along with other small craft, have on hand two new *Cluthas* for the Glasgow harbour passenger service of the Clyde Trust.

Messrs. Russell & Co., Port Glasgow and Greenock, are building an enormous five-masted sailing ship, to be fitted with auxiliary power to propel her in calm weather. She will have a carrying capacity of 7,000 tons; a four-masted sailing ship of 2,500 tons to the order of Messrs. David Bruce & Co., Dundee, to be employed in the jute trade between India and Dundee; a steel barque of 1,500 tons for Mr. F. Stray, of Denmark; four twin-screw triple-expansion steamers, each of 300 tons and 500 effective H.P., for the Amazon Steam Navigation Co., to be engined by Messrs. Kincaid & Co., Greenock; a saloon passenger steamer for the Caledonian Steam Packet Co., and similar in every way to the company's steamer *Marchioness of Bredalbane.*

Besides Messrs. Russell & Co., the other Port Glasgow firms are fairly well-off for work. Messrs. Blackwood & Gordon are just finishing the *Iris*, a fast twin-screw steamer of 260 ft. in length and 1,700 I.H.P., for Messrs. Hill, Gomes & Co., for South American trade, and similar to the *Satellite*, a remarkably successful steamer finished some months ago for the same firm. They are also at work on a paddle steamer of 262 ft. 10 in. long, 27 ft. broad, and 14 ft. 6 in. deep, for the City of Dublin Steam Packet Co., to trade between Dublin and Liverpool. Messrs. Robert Duncan & Co. have on hand a four-masted steel ship, of about 2,600 tons, for Mr. Robert R. Patterson. Messrs. William Hamilton & Co, are building a steel sailing ship of 2.200 tons, to be engaged in general trade; and Messrs. D. J. Dunlop have amongst their work on hand a steel screw steamer, of 1,800 tons, and 2,100 H.P., for general trade; a screw steamer of 550 tons, for service on the Australian coasting trade; and two screw yachts, of 310 tons and 800 H.P., and 200 tons and 300 H.P., respectively.

At Greenock Messrs. Scott & Co. are constructing three sets of engines of 9,000 H.P. each for the British Government, and besides several large vessels for the Gulf Line of the Greenock Steamship Co., have orders on hand for building and engining a steel screw steamer of about 3,000 tons, for the China trade of Messrs. John Swire & Sons, London, and a steel steam yacht of about 1,200 tons, which, when built, is expected to be one of the largest afloat, and the speediest. Messrs. Caird & Co., of the same town, besides other more important work on hand, have lately booked the order for a screw steamer of about 1,500 tons and 2,000 H.P., for the cargo and cattle carrying trade of Messrs. Burns, between Belfast and Scotch ports.

On the Ayrshire coast the several shipbuilding ports are well stocked with work. The Ailsa Co., of Troon, have on hand six steamers, with an aggregate tonnage of 4,800 for various lines; and Messrs. S. Macknight & Co., at Ayr, are at present building in all five steamers aggregating 1,860, one of which is a saloon passenger steamer of 215 ft. long, 24 ft. broad, and 8 ft. 6 in. deep, to ply between Bristol and Tenby. Messrs. Hutson & Corbet, Glasgow, are to supply the engines, which are expected to develop 18 knots per hour.

Of Marine engineering firms, who are not themselves shipbuilders, the same report has to be made, viz.—a fair amount of work on hand. This applies to the following firms; Messrs. J. & J. Thomson, Finneston; Hutson & Corbett, Kelvinhaugh; David Rowan & Co., Cranstonhill; Dunsmuir & Jackson, Govan; Messrs. Ross & Duncan, Govan; Muir & Houston, Kinning Park; Wm. Kemp, Govan; Wm. King & Co., Limited, Paisley Road; Messrs. Kincaird & Co., Greenock; and Rankin & Blackmore, Greenock.

The James Watt anniversary dinner was held, under the joint auspices of the Philosophical Society of Glasgow and the Institute of Engineers and Shipbuilders, in the Windsor Hotel, St Vincent Street, Glasgow, on the night of the 19th ult. About 140 sat down to dinner. Professor McKendrick, the president of the Philosophical Society, occupied the chair, while Messrs. John Ward, Robert Dundas, and George Herriot, vice-presidents of the Institute of Engineers and Shipbuilders, discharged the duties of croupiers. Among those present where Sir Wm. Thomson, Sir Wm. Arrol, and Professar Max Müller. Mr. John Ward, of Messrs Denny & Bros., Dumbarton, in proposing "The Town and Trade of Greenock, Watt's Birthplace," referred to the great advance that town had made within recent years, and suggested that the Harbour Trust should make the Garvel Dock equal to the capabilities of the work done in Greenock and in the upper reaches of the Clyde. While some of the largest vessels that had ever been built in Greenock had already been placed or would soon be placed there, yet unless a crane or sheerlegs or something of that kind was erected these ships would require to go to Glasgow to get in their boilers.

Messrs. R. C. Wallace & Co., engineers, of Finneston Quay, Queen's Dock, Glasgow, have recently extended their premises by adding commodious new offices, a fitting shop and a turning shop, and are gradually remodelling their extended works so as to better enable them to overtake the production of their patent steam steering gear, for which there is a steady and increasing demand.

Messrs. A. Mabon & Co., mechanicians and model-makers, of 10, West Campbell Street, Glasgow, in addition to the variety of work previously on hand are at present engaged on the deck fittings and other items of equipment for a model, on ¼-in. scale, of one of the large first-class cruisers now on the stocks of one of the large North of England shipyards. The production of these multifarious and minute little counterfeits of the full-sized articles of ships outfit, is now quite an industry in Glasgow, although from the minute and very special nature of the work, only a few firms are able to engage in it successfully.

Messrs. Kelso & Co., of 2, Commerce Street, Glasgow, whose exceptional skill in this same branch has for many years been well known, continue to be inundated with orders, many of which are being executed in view of the forthcoming Naval Exhibition at Chelsea. This firm have recently been under the necessity of largely increasing their working staff, and with this in view they are engaging new workmen, and recalling their experienced model-making hands, who have for some time been engaged on work connected with electric-bell fitting on Government cruisers—a branch of this firm's business which is now pretty extensive.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The prolonged holiday period which is observed at the advent of a New Year has on this occasion been further lengthened by the severe weather that has prevailed almost without intermission during the three weeks that have passed, and no progress to speak of has been made with the contracts on hand. Perhaps the lack of pressure for delivery on the part of customers may to some extent account for the temporary inaction that is now to be noticed at many shipbuilding establishments; but this is a feature of the situation which may naturally be expected to be present, when shipowners can find so little chance of profitable employment for their vessels, that they are laying them up by the score. There are now some 70 or 80 vessels laid up on the Tyne, and as their number is being added to every day, it is not improbable that within the next few weeks the aggregate amount of idle tonnage on the river may pretty nearly approximate to what it was in the winter of 1885-86. This wholesale laying up of tonnage, of course, confirms the opinion which from time to time has been expressed in these Notes, which was to the effect that through the abnormally large production of the past two or three years, the carrying power of the world was far in excess of all present requirements, and that a greatly lessened demand for tonnage must result, with a consequent decrease of work for the shipbuilders. The decrease of work is already very apparent, as many establishments show a much smaller amount of tonnage on the stocks than there is room for, and enquiries respecting the placing of new orders having entirely ceased, the scarcity of work in the yards may soon be expected to become more generally felt. It may be remembered that last autumn the shipbuilders of the North-East Coast issued a notice for a reduction of wages, and that owing to a somewhat sudden and unlooked-for improvement in the demand for vessels, the notice was subsequently withdrawn. The spurt having, as is now generally recognised, completely exhausted itself, an opportunity again arises for the shipbuilders to adopt the necessary measures for reducing the cost of production, and thus offering to shipowners some inducement to replace old and ineffectively-engined vessels by new ones, constructed and engined according to modern principles. Herein lies what appears to be the only prospect of an early improvement in the industry, and it may be presumed that the shipbuilders will not long forego the chance of adapting themselves to the exigencies of the time. Messrs. Armstrong, Mitchell & Co. have now very little work at their Elswick establishment, but at their Low Walker yard there are three vessels in advanced stages, and three others framed or in course of framing, one of the latter being of exceptionally large dimensions. There is also a large vessel moored beside the yard, and the absence of a name on this would appear to indicate that it is unsold. Messrs. W. Dobson & Co. have a large vessel nearly ready for launching, and two others are in the plating and framing stages respectively. Messrs. Hawthorn, Leslie & Co. have commenced the framing of an exceptionally-large passenger steamer ordered by Russian owners, and they have some three or four others of smaller dimensions, in different stages of progress, on the stocks. The graving dock is also occupied, and the whole establishment wears an appearance of healthy, though not extreme, activity. Messrs. C. S. Swan & Hunter have four vessels on the stocks, and there are two handsomely-designed steamers being fitted out beside the yard. The Palmer Shipbuilding & Iron Co. are now preparing, by extensive piling and other arrangements, the berth in which a second line-of-battle ship, ordered by the Admiralty, is to be laid down, the first being now so far advanced in construction as to show the outline of the lower, or protective deck. The firm have launched a cruiser lately from their Howden yard, and are now placing blocks in the vacated berth for the reception of a large merchant vessel. Messrs. R. Stephenson & Co. have several building berths vacant, and there appears to be very little prospect of these being soon filled up. The Edwards Shipbuilding Co have a new vessel beside their yard, which is understood to be unsold, but there is a fair prospect of work in the establishment for some months to come, as two vessels of good size are now being laid down. The Tyne Shipbuilding Co. have still a good show of work in the yard, and continue to employ a full complement of men. Messrs. John Readhead & Co. have more than an average share of new work in hand, and are making arrangements to largely extend the scope of their repairing operations. With this object in view, they some time since acquired possession of a graving dock in the vicinity of their yard, and are now enlarging it, so as to render it capable of receiving vessels of the largest class. The dock will be supplied with all modern accessories calculated to facilitate the work of docking and undocking; among which may be mentioned two 30-in. centrifugal pumps, ordered from Messrs. Tangye & Co., Birmingham, through their Newcastle agency. These pumps, it may be stated, will be the largest and most powerful in the district, excepting only those in use at the Wallsend Pontoon Co.'s dock, which are 36 in. in diameter, having been also supplied by Messrs. Tangye & Co. Messrs. Wood & Skinner, Messrs. Schlesinger & Davis, and Messrs. T. W. Smith & Co. have only a limited amount of work on hand, but the three small yards at Shields, which are devoted to the building of small craft, continue to be kept fairly busy.

Engineering.—A committee of the Amalgamated Engineers' Society, which is understood to act on behalf of the operatives of the Tyne, Wear, and other places, have intimated to the employers that henceforward certain restrictions on the working of overtime would be enforced in the various works. No action likely to bring about an open rupture has been as yet taken by the employers in reference to this matter, but it may be taken for granted that in some instances the restrictions will prove extremely vexatious, and it is hardly probable that the employers will long maintain a quiescent attitude in respect of them. The Wallsend Slipway and Engineering Co., who last year turned out the large total of 26 sets of triple-expansion engines, having an aggregate I.H.P. of 40,170, are still keeping busy, and are likely to continue so for some time to come. The North-Eastern Engineering Co. are also having an adequate amount of work in hand, and have lately taken into their own hands the extensive and well-appointed forge adjacent to their engineering works, which was for some time worked as a branch establishment by a firm having its headquarters in South Durham. Messrs. Hawthorn, Leslie & Co. are now engining at S. Peter's a war vessel recently launched from the Elswick Yard, and have a great amount of other work of a similar class in progress in the shops. The firm are busy with locomotive and other work at the Forth Bank's establishment, and their large foundry is kept going to its fullest capacity. Messrs. Donkin & Nichol, of the St. Andrew's Engine Works, turned out last year no less than 60 steering-gears, besides a number of ash hoists, engine-room telegraphs, and other specialities. The firm are still busy on unfulfilled contracts, but like other manufacturers in the same lines of business, are booking no new orders. The various departments of Messrs. John Abbot & Co.'s works continue well employed, and at Messrs. Clark, Chapman & Co.'s works business is also tolerably good. Messrs. Ibbotson, of Sheffield, will shortly commence the steel plate manufacture at the works formerly occupied by Messrs. Hawks, Crawshay & Sons. The boilers are now being placed in position, and other arrangements are being made with a view to an early commencement of operations. A local firm of iron manufacturers will shortly start new works in the vicinity of Dunston.

THE WEAR.

Shipbuilding.—The difficulty of obtaining supplies of material from the steel manufacturers, combined with the unfavourable weather, is causing much hindrance to the progress of work in the different yards, and since the beginning of the year a very large proportion of the operatives' time has been spent in enforced idleness. Messrs. W. Doxford & Sons are just now engaged in building one of the largest sailing ships that has yet been constructed on the Wear, and Messrs. R. Thompson & Sons have also a large sailing ship in progress, and another of similar dimensions fitting out beside the yard. The firm have also a steamer of large tonnage in an advanced stage, and frame-turning for other vessels is proceeding. Messrs. Short Bros. have four berths occupied, the vessels on the stocks being in the different stages of framing, plating, and getting prepared for launching. At Mr. Laing's yard there are also four vessels in progress, three being in early stages, while one is being got ready for launching. Messrs. Priestman & Co. have an abundance of work, most of the vessels on the stocks being in early stages of building, and at Messrs. Pickersgill's yard the work in hand is sufficient to keep a full complement of men employed. The North Sands yard keeps fairly busy, advantage having been taken of a ten days' holiday at the beginning of the year to carry out some necessary repairs to the plant and machinery. Messrs. Austin & Co. have only one vessel on the stocks, but at Messrs. Blumer's yard, and also at the establishment of the Sunderland Shipbuilding Co., the berths are fully occupied.

Engineering.—At the Palmer's Hill Engine Works business keeps fairly active, though less pressure is being experienced in some departments. A remarkable achievement, and one which speaks volumes for the energetic way in which work is carried out at this establishment, was performed early in the month, when a new vessel was brought to the wharf and sent away again within 24 hours, with her engines and boilers fitted, and steam up. Many smart feats in the way of engining vessels have been reported within the past couple of years, but we believe that nothing to equal this has been noted in connection with the carrying out of such work. For some time past a portion of the machinery at these works has been driven by an "Otto" gas engine, and it is understood that the utilisation of gas power is now to be further extended: with this object in view preparations are being made for the putting down of one or two more "Otto" engines to be supplied by the manufacturers, Messrs. Crossley Bros., Manchester. Messrs. Clark & Co. have still a good many important contracts uncompleted, and at the North-Eastern Engineering Works a continuance of the existing briskness is assured for some time to come. In the smaller engineering works generally there is a noticeable lessening of activity, and the same remark applies to forges and anchor works. Iron foundries, brass works, and copper works, still keep pretty busy, and manufacturers of wire rope for ships' rigging and colliery purposes are well supplied with orders. The women-workers at Messrs. Craven & Speeding's rope factory have been striking for an advance of wages, and much inconvenience has resulted from their action. At the time of writing, negotiations for the settlement of the dispute are, it is understood, in progress. The strike of miners at Silksworth Colliery is still unsettled, and a ballot which was recently taken shows that nine-tenths of the men are for remaining "out." Fortunately the cases mentioned are the only instances of labour disputes now existing in the district.

The Hartlepools.—An election contest, caused by the death of the late lamented member for the borough (Mr. Thos. Richardson, J.P.), has taken place at this centre during the month, and for the time being industrial affairs have, it is to be feared, been relegated to a position of secondary interest. At the time of writing however, the contest has just been brought to a close, and it is to be hoped that all parties have again settled down to the pursuit of their ordinary avocations. In the shipbuilding yards fully sustained activity exists, this being about the only centre on the North-East Coast which as yet shows no indications of a falling off. That there is a falling off, however, admits of no doubt; but it is only so far as concerns the booking of new orders, and there is so large an amount of work in reserve, that some months must elapse before this kind of declension can have any marked effect on the current business of the yards. In the engineering establishments business is also very active, but the efforts of managers to turn out work with the customary punctuality are greatly hampered by the unwillingness of the operatives to work overtime. This hindrance to business is especially felt in the outside repairing departments, and so serious has it become that Messrs. Richardson & Co. have decided on entirely refusing this class of work.

Stockton.—The shipbuilding yards continue tolerably busy and although there are no new contracts being arranged for, slackness is not likely to be felt for some months yet. Messrs. Riley Brothers, boilermakers, &c., are still very fully employed, and have recently added to their plant a hydraulic riveting machine. Messrs. Blair & Co. have sent on their trial trips, since the middle of last month, the following steamers:—The s.s. *Cabo Silbeiro*, built by Messrs. J. L. Thompson & Sons, of Sunderland, for Messrs. Ybarra & Co. of Seville, having engines of 85 H.P. nominal with cylinders 15½ in., 26 in., and 42 in. by 30 in. stroke. The s.s. *Llanthony Abbey*, built by Messrs. Ropner & Son, Stockton, for Messrs. Pyman, Watson, & Co. of Cardiff, having engines of 175 H.P. with cylinders 22 in, 36 in., and 59 in. by 39 in. stroke. The s.s. *Bombay*, an old vessel owned by Messrs. Nelson, Donkin & Co., of London, having new triple-expansion engines of 220 H.P. nominal, with cylinders 23½ in., 39 in., and 64 in., by 42 in. stroke. The s.s. *Cabo Prior*, built by Messrs. J. L. Thompson & Sons, for Messrs. Ybarra & Co., having engines of 85 H.P. nominal, with cylinders 15½ in., 26 in., and 42 in., by 30 in. stroke. All the above engines are constructed to work at 160 lbs. pressure of steam, and on their trials gave complete satisfaction. Messrs. Blair & Co. have also just finished fitting the s.s. *Gulf of Florida*, a new vessel built by Messrs. Hawthorn, Leslie & Co. for Messrs. The Greenock Steamship Co., with a complete electric light installation of 80 16-candle power lamps, including masthead, side, and portable deck lights. This is the fifteenth vessel Messrs. Blair & Co. have fitted with the electric light for the same firm. The Stockston Forge Co. have some important orders on hand, and the works of Messrs. Wrightson & Head are kept busily employed on contracts for bridges and railway plant.

Middlesbro'.—The shipbuilding yards of Messrs. Raylton Dixon & Co. keep fairly busy, and Messrs. Craggs & Co. have two steamers on the stocks. This firm have put down a large gas-engine to drive the machinery in their shops, and are utilising the old steam-engine for working their patent slip. Messrs. Harkess & Son are by the aid of their improved facilities getting on most satisfactorily with the contracts in hand, and bid fair in the year which is now entered upon to do at least as well as they did last year.

Darlington.—The Darlington Forge Co. have had a most successful year in that just ended, and we are glad to be in a position to give some particulars of the output. The total turn-out of completed work in 1890 was as follows:—

Steel and Iron Forgings - -	4,870 tons.
Steel Castings - - - - -	2,970 „
„ Ingots - - - - -	2,840 „

To obtain so large an output as is represented by the foregoing figures, the Company have had to enormously increase the size of their works, which are now fully three times as large as they were four years ago, giving regular employment to no less than 1,000 hands. An analysis of the output returns shows that there were 396 steel and iron crank shafts; 82 stern frames, 49 of which were iron, and 33 cast steel; and 102 rudder frames, 81 of which were of iron, and 21 cast steel. The average weight of the stern frames was 8 tons 7 cwt. each, and of the rudder frames 3 tons 1 cwt. Among the heavier specimens of work turned out were 4 three throw hollow ingot steel crank shafts for H.M.'s first-class battleships *Royal Sovereign* and *Renown*, building at Portsmouth and Pembroke, respectively. The 12 ingots for these crank shafts weighed in the aggregate over 400 tons. In the matter of rapid execution, a feat has just been accomplished, at the works, which deserves special notice, as we believe it to be quite unique. This achievement was in connection with the manufacture of a single crank shaft, 15½ in. diameter, 9 ft. 4 in. over all, and 5 ft. stroke, made to the order of Messrs. D. & W. Henderson & Co., Glasgow, for the Allan liner s.s. *Corean*. The forgings for this large shaft were commenced on the morning of January 5th, directly on restarting the works after the New Year holiday stoppage, and the shaft was built up, turned, and finished ready for despatch by the following Monday, January 12th, exactly six days from starting the job, or five actual working days, the work in connection with it having been temporarily suspended on Saturday, January 10th. This is a record which has never been beaten with a shaft of these dimensions, although some time ago the Company turned out in some eight hours more time a single built crank-shaft, 15½ in. diameter, weighing 6½ tons, for the British India liner, *Ronia*.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—There is not much that is new to report in the shipbuilding trade of this port. There have been no new orders to report, although negotiations for very important contracts are on the eve of settlement, and others have practically been secured. It is evident on all hands that continued activity will be maintained at local shipbuilding establishments not only during the current, but during the ensuing year. Not only have the Naval Construction and Armaments Co. more tonnage under construction than they launched last year when they were busy, but they are also exceedingly busy in the engineering works, where they have contracted to build all the engines for the new steamers under construction except one—that of Mr. Jas. Little's new steamer of 3,400 tons—the engines for which are being built by Messrs. Westray, Copeland & Co., Limited, Barrow. The *Empress of India*, the pioneer of the new Canadian-Pacific Railway Co.'s fleet of high-class steamers to connect the Western Pacific coast of Canada with Japan and China, left Barrow in the early part of January for a series of what have proved most interesting trials. On her journey from Barrow to Liverpool with only one set of her engines working, she steamed 15 knots, but subsequently on the measured mile on the Clyde, with both screws going, she steamed at the rate of 18¼ knots per hour, or about 21 miles. She covered the distance in 3 min. 17 sec. Her postal speed of contract was fixed at 17½ knots. The owners of the vessel, the Admiralty, the

Postal Department, and the builders are also highly gratified at the result of this trial, as it not only affords proof that the new steamship service across the Pacific will reduce the voyage to the smallest possible time, but will expedite the mail service and give to the Admiralty in case of their being required the best possible class of high speed passenger ship, in the construction of which Admiralty requirements have had prominent consideration. The *Empress of Japan*, sister ship to the *Empress of India*, which was launched at the close of last year, is now receiving her engines, boilers, and fittings under the 100-ton crane in the Devonshire Dock. She will be ready for sea in March. In the course of a week or two the third steamer of this fleet, the *Empress of China*, will be launched, and she is to be ready for sea in April. The cruiser for the Admiralty, the *Latona*, the pioneer of the fleet of war ships embraced in the Naval Defence Act of 1889, has been delivered at Portsmouth, and in her trials between Barrow and that port gave every satisfaction not only in the matter of speed, but sea-going qualities. The *Melampus* and the *Naiad*, sister cruisers to the *Latona*, are being fitted up in the Devonshire Dock, and it is expected the *Melampus* will be handed over to the Admiralty in about a couple of months. The Naval Construction and Armaments Co. are busy on fourteen other orders, and are expecting to lay down on the ways occupied by the three Canadian steamers, two of which have been already launched, a fleet of fast Atlantic liners, in connection with the Canadian Pacific Railway Co. Four of these will be employed in the Atlantic service and three on the service between Vancouver and Australia. Other important work is also pending. The Naval Construction and Armaments Co. have determined to make large extensions in their engineering shop at Barrow. This has been necessitated by the fact that, although the works are employed night and day, the orders in hand and those expected cannot possibly be completed by the means already possessed. The price of steel shipbuilding material has gone down during the month in consequence of the demand having fallen off. Plates are at £6 5s., angles at £5 10s., and boiler plates at £7 2s. 6d. per ton.

Whitehaven.—No success has attended the efforts which have been made to dispose of the Whitehaven Shipbuilding Yard, and it is to be offered for sale by public auction.

Workington and Maryport.—Shipbuilding on the Solway is not an active industry, but the two yards at Workington and Maryport are fairly employed on small classes of work, and are likely to be fairly busy during the year.

THE MERSEY.

THERE is still no very material change to report in the condition of the shipbuilding and marine engineering trades of this district. There are a moderate number of inquiries with regard to new vessels, but many scarcely mean actual business. Still several orders have been placed during the past month and trade is perhaps not quite in that stagnant condition that it was a short time back. Shipbuilding material has during the last few months fallen considerably in price, and this enables shipbuilders to some extent to tender for new work with more chances of success, but as regards wages there is no relief whatever, nor do the men show any disposition to meet the employers upon reasonable terms, under the altered conditions of trade. In one or two instances they have moderated slightly the extreme demands which were put forward and which rendered the commencement of new work altogether out of the question, but the whole position of affairs as regards labour questions is so unsatisfactory and so uncertain that shipbuilders are very chary about entering into contracts which, in the first place, are not obtainable at all with the prospect of anything like remunerative results, and may possibly before they are completed be surrounded by various labour and other difficulties which may induce serious complications with regard to the fulfilment of engagements. So long as this unsatisfactory condition prevails any material revival of activity can scarcely be looked for, but it is to be hoped the men, if only in their own interests, will see that they, as well as employers, must share in the less profitable condition of trade.

Messrs. Laird Bros., of Birkenhead, report a fair amount of inquiry with regard to new work coming forward, and they have booked one or two new orders for ships of the mercantile class. Considerable interest just now attaches to the fate of the two torpedo gunboats, the *Almirante Lynch* and the *Almirante Condell*, recently completed by Messrs. Laird for the Chilian Government, which are now fully equipped and on the way to their destination. It is stated that the rebel steamers are on the look-out for these new gunboats, but so long as they have plenty of searoom they will be readily able to show their heels to any other Chilian war vessel at present afloat. A few additional particulars of the torpedo gunboats *Rosales* and *Espora*, which have now been completed and will shortly proceed to their destination, will be of interest. These two vessels mark a distinct step in the evolution of that type of war ship of which the *Rattlesnake*—also built by this firm—was the first example. The *Rosales* and *Espora* are each 200 ft. long by 25 ft. beam by 13 ft. 6 in., moulded, depth. At the above-mentioned draught—8 ft.—the displacement is 520 tons, and the freeboard amidships about 5 ft. Steel is used in the construction of the hull. There is no keel proper, but two deep bilge keels are fitted. Steel is used too for the stem, stern frame, rudder frame, and propeller brackets. The vessels are subdivided by longitudinal wing bulkheads, watertight flats, and transverse bulkheads into 42 watertight compartments, the capacity of each being comparatively so small that with several compartments pierced, there would be no great change in the trim of the vessel. These vessels are built with a topgallant forecastle and raised poop, thus providing an amount of seaworthiness and habitability which are wanting in the case of the *Rattlesnake* and similar vessels. Considerable protection against gun fire is afforded by the disposition of the coal bunkers, which completely surround the engines and boilers, the total coal capacity being about 130 tons, the normal amount carried being 100 tons, which, at a speed of 11 knots, gives a radius of action of 3,000 knots. Protection is further afforded by doubling the sheerstrake in the wake of the engines and boilers. The upper deck, too, is of steel, and is sheathed with 2-in. teak. On the topgallant is a conning tower of 1-in. steel. The armament consists of two 14-pounder Nordenfeldt guns on the forecastle mounted *en enchelon*, each with an arc of training of 225 degrees, one 8-pounder on the after-end of the poop with an arc of training of 310 degrees, and two 3-pounders mounted on the fore part of the poop, each with an arc of training of 160 degrees. There are also two Nordenfeldt revolving cannon. In the waist are four impulse tubes for discharging the 18-in. torpedoes, while in the stem is a fixed Whitehead torpedo tube also 18 in. in diameter. The propelling machinery consists of two sets of tri-compound engines, the diameter of the cylinders being 19 in., 28½ in., and 42 in. by 19½ in. stroke. Each cylinder and its valve-chest are carried on four turned steel columns, the feet of which are splayed out and secured to the engine framing. The trials of these vessels have extended over a considerable period, and a mean speed of 19·823 knots has been obtained with the very moderate air pressure in the stokeholds of 2 ft. 6 in. The consumption trials established that, at a speed of 10·86 knots, the consumption was 66 lbs. of coal per knot. Externally these vessels have a decidedly dashing appearance, and one remarkable point about them is the absence of vibration when going at full speed. In previous reports we have referred to the refitting by Messrs. Laird of the London and North Western Co.'s paddle steamer *Violet* with triple-compound engines, and it will be interesting to give a few particulars of the test trials which have been made. The *Violet* was built and engined by Messrs. Laird for the London and North Western Railway Co. in 1879 for their fast mail and passenger service between Holyhead and Dublin. She was fitted with a pair of simple oscillating engines, the cylinders being 78 in. in diameter with 7-ft. stroke, and the power they developed was 3,200 I.H.P. On her trial trip, with the engines running at 28 revolutions, she attained a speed of 17·75 knots. About two years ago, however, the London and North Western Railway Co., finding it desirable to increase the speed of their Channel steamers, determined to re-engine and re-boiler the *Violet*, and entrusted Messrs. Laird Bros. with the work. Very onerous conditions were laid down by the railway company. The chairman, Sir Richard Moon, through Admiral Dent, R.N., the marine superintendent, insisted that the new engines should not occupy greater fore-and-aft space; the power was to be about 30 per cent. more, and the existing passenger and cargo space was not in any way to be encroached upon, nor was the position of the paddle-shaft to be altered. To put such a large power as was intended in the small length available rendered the adoption of the steeple-engine imperative. So well has the design been worked out that the new engines develop 27 per cent. more power, while the weight of the machinery is less by

25 tons than in the original engines. The new engines consist of a set of tri-compound steeple-engines, the cylinders being 44 in, 70 in, and 108 in. in diameter, with a stroke of 6 ft. 6 in. The cylinders are bolted without the intervention of any bed-plate to the engine-room keelson by ordinary holding down bolts and secured to the entablature above by 12 wrought-iron columns, four to each cylinder. Owing, too, to the small athwartship space in which it was necessary to place three cranks in lieu of two, the valve-chests had to be placed on the foreside, and eccentric motion dispensed with. The type of valve gear adopted is Joy's, which is well known as possessing the good points of occupying little room, and giving an easy cut-off and better steam distribution. Piston valves are used for the H.P. and M.P. engines, and a balanced D slide for the low-pressure engine. The reversing gear is attached to the upper framing, which supports the guides and is worked by Brown's steam and hydraulic engine. A vertical triple-compound engine similar to those used on torpedo boats is placed immediately over the three air-pump cylinders, and the pistons of the steam-engines have a crosshead with forked arms, which are united by a similar crosshead carrying the connecting rod, the arrangement being on the return connecting-rod principle. The whole makes an exceedingly compact and smooth-running engine. Steam is generated in six boilers of the loco-marine type at a pressure of 150 lbs. on the square inch. These boilers, which are of steel, are placed in two groups of three each in two closed stokeholds, and are similar to those fitted in torpedo boats; being of comparatively small diameter, they do not interfere with the main deck's beams, which are not cut away. The total heating surface in all the six boilers is 10,022 square feet, and the grate area, 282 square feet. The paddle-wheels have been reduced in diameter by 24 in., retaining, however, the same number and area of the floats as before. All the alterations and improvements have been made under the immediate supervision of Admiral Dent, R.N., marine superintendent, assisted by Mr. Beal. The first official trials, owing to bad weather, were only partially carried out, but taking advantage of a brief spell of clear weather, the engines were run at 36 revolutions, the steam pressure being 140 lbs., the I.H.P. 4,087, and the speed 19·3 knots, maintained with air pressure not exceeding ·6 of an inch. Since the above trials the vessel has made several trips from Holyhead, and although nothing actually definite can at present be said with regard to the speed attained except that it is in every respect satisfactory, it is fully expected that she will attain a speed of quite 20 knots per hour.

Messrs. Royden & Sons have secured a contract for building a new vessel to be named the *Alcesto*, which is being built for a company that has been formed with a capital of £22,000 to purchase and work the ship, her tonnage being about 2,200 to 2,300. Last month reference was made to the effect that the above firm had just completed the new steamer *Obidense* for Messrs. Singlehurst & Co., and we are now able to give a few additional particulars of this vessel—which has been specially built for combined passenger and cargo traffic—and the very successful results of the trials that have since been made. The *Obidense* is a steel-built single-screw steamer. She is 300 ft. long, 37 ft. beam, and moulded depth of 26 ft. When at the load draught of 21 ft. (mean) she carries 2,800 tons of deadweight. The hull is built of steel, with frames of channel section. The vessel is built much in excess of classification rules, and has an unusual amount of strengthening in the shape of extra stringers and intercostals. She is a flush-decked ship with two iron decks, and has a full poop, long bridge and topgallant forecastle. She has accommodation for 80 first-class and 200 steerage passengers. The furniture and upholstery fittings of the ship are remarkable for elegance of design and high-class workmanship, and have been supplied by Messrs. A. Blain & Son, of Liverpool. The machinery, supplied by Messrs. Fawcett, Preston & Co., consists of a set of tri-compound engines, the cylinders being 29 in, 46in, and 74 in. diameter, with a stroke of 48 in. The propeller is a right-handed four-bladed one of cast-iron. Steam is supplied at a working pressure of 175 lbs. per square inch by two double-ended steel boilers. In the official trials a series of runs were made, with the following results:—Mean draught, about 15 ft.; steam in boilers, 175 lbs.; in M.P. receiver, 65 lbs.; in L.P. receiver, 11 lbs.; vacuum, 27 in.; revolutions, 75; total I H.P., 2,900; mean speed, 17 knots. The H.P. and speed it may be added are largely in excess of the contract, and it is anticipated that when laden a sp[illegible] of 14 knots will be maintained at sea. Altogether the [illegible] one of the finest vessels of her class that has been turned out of Liverpool, and reflects the highest credit on both her builders, Messrs. Royden & Sons and Messrs. Fawcett & Preston, by whom she has been so efficiently engined.

In the iron trade of this district the past month has witnessed no revival from the depressed tone which characterised the market at the opening of the year. Business both in pig and finished iron has continued nearly all through extremely slow, and prices have shown a strong downward tendency. So far as pig-iron is concerned the weakness in the warrant markets at Glasgow and Middlesbrough has no doubt operated largely in unsettling the minds of consumers here, and although in most cases their stocks have been allowed to run down to the lowest possible point, they still hold back from buying anything like quantity. A still further reason for this reluctance to purchase beyond band-to-mouth requirements is the uncertainty with regard to the future. Buyers naturally believe that the termination of the strike of blast furnace-men in Scotland cannot be much further prolonged, and that when operations are resumed at the furnaces the large additional quantities of iron thus thrown upon the market must necessarily tend to bring down prices still further. Then again there is an uncertainty with regard to the outlook of trade and an indisposition to enter into forward engagements, which all tend to restrict business to very narrow limits. For delivery in the Manchester district local brands of pig-iron have got down to 47s. 6d. for forge to 48s. 6d. for foundry. District brands do not average more than 45s. and 45s. 6d. for forge to 47s. 6d. and 48s. for foundry, Lincolnshire, and from about 45s. 6d. and 46s. for forge to 50s. and 52s. for foundry, Derbyshire, less 2½ delivered here. Where business of any weight has been done even lower figures than the above have been taken, but these may be regarded as about the present current average rates. For outside brands, Middlesbrough has been readily obtainable at about 51s. 4d. to 51s. 10d., but in Scotch iron, owing to the scarcity of some of the brands, prices have been irregular, and Eglinton especially it is difficult to quote within a margin of 1s. to 1s. 6d. per ton, but 60s. represents about the present minimum figure that holders would accept for delivery equal to Manchester.

Manufactured iron has settled down into a very depressed condition, local makers not securing sufficient work to keep forges anything like fully occupied, and, to secure specifications, extremely low figures are being accepted, although makers do not care to contract forward at current rates. For delivery in the Manchester district, bars can be readily bought at £6 to £6 2s. 6d., hoops at £6 5s. to £6 7s. 6d., and sheets at £7 10s. to £7 15s. per ton.

In the steel trade business has also been very quiet all through the month, except that there have been occasional fair transactions in hematites, which have fluctuated somewhat in price but the general tendency has been downwards, good foundry qualities with the close of the month not averaging more than about 62s. 6d., less 2½ delivered in the Manchester district. Steel plates for either boiler-making or shipbuilding purposes have met with very little inquiry, and for these prices have again got down to an extremely low point, which makers complain is considerably under the actual cost of production. For good boiler-making qualities of steel plates, makers, in many instances, are ready to accept £8 per ton for delivery to consumers in the neighbourhood of Manchester, and merchants are quoting fully 2s. 6d. under this figure to secure any orders that are coming upon the market. Steel plates, suitable for shipbuilding purposes, have got down to about £6 15s. per ton as an average figure, at which they could now be bought for delivery ex-steamer Liverpool. There is one feature, however, in connection with this branch of trade, the protracted railway strike in Scotland has so far interfered with operations at Scotch steel works that deliveries of plates into this district have been in some instances entirely suspended for the time being, and in one or two cases work at the shipyards on the Mersey has been brought to a standstill owing to the non-delivery of steel ship-plates required to carry on operations.

The engineering industries outside marine work continue generally well employed, especially as regard general engine builders, land boiler makers, locomotive builders, and machine-tool makers, who, with few exceptions, have not only sufficient work in hand to keep them going for some time to come, but report a fair amount of new work coming forward. Amongst marine engineers, however, there is very little new work giving out, but some of the large firms in the Liverpool district are being kept busy upon foreign orders for general engineering plant. The returns of the trades union organisations show some increase in the number of out-of-work members, but this is due more to the usual suspensions after the holidays and for stock-takings than to any actual decline in trade, although there is not that pressure for men as was the case a few months back, and there is, no doubt, a slackening off as regards the weight of new orders giving out.

In the metal market there is a continued fair demand for various descriptions of manufactured goods, but these are chiefly for inland purposes and largely for locomotive construction. The recent fall in the price of raw material has, however, been followed by a general reduction in the list rates for various manufactured metal goods, and for delivery in the Manchester district. Solid drawn brass tubes are now quoted at 7¼d, solid drawn brass surface condenser tubes 8¼d., solid drawn copper tubes 8¾d., brazed copper tubes 8½d., brazed brass tubes 8½d., yellow metal condenser plates 6¼d., brass 7d., copper wire 8¾d., sheet brass 7¾d., and rolled brass from 6¾d. to 7¼d. per lb.

In the timber trade imports have generally been moderate, but the deliveries have been more than usually curtailed, owing to the severe weather. There is no change to report in values, and stocks continue quite ample.

The coal trade has been in a very disorganised condition during the past month, owing to the almost entire stoppage of transit over the canals for a considerable period, and the general blockage of the mineral traffic on the railways. This has prevented deliveries from the collieries, and pits in many cases have had to cease operations owing to the inability of the railway companies either to take mineral traffic on their lines or to return empty waggons after they have reached their destination. The result has been that at the ports on the Mersey there has been a great dearth of coal to meet requirements, and many vessels have been delayed for days waiting for cargoes. In many cases special prices have been paid to secure prompt deliveries of supplies for steamers or cargoes for vessels, but as an improvement is now generally taking place, and deliveries are coming to hand better than they have been, these figures are only temporary. For delivery at the High Level, Liverpool, or the Garston Docks, the current market rates for good ordinary qualities of steam coal may be quoted as firm at about 10s. 6d. per ton.

THE THAMES.

NOT for very many years past has the river and valley of the Thames presented so Arctic an appearance as it did on the advent of 1891. The severe frost of early December, followed by heavy snowfalls, and succeeded by still more severe frost, completely altered the aspect of the river, and for weeks the large masses of snow and ice which broke away from its upper reaches went drifting up and down with each tide, accumulating as time went on, till the broad bosom of the water was all but covered from side to side by immense "floes," these in turn becoming "packs"; and standing on, say Waterloo Bridge, it required no great effort of the imagination when looking down the river, to fancy one's self transported to the Polar regions and forming one of an expedition in search of that celebrated stick—the North Pole. In the lower reaches matters were even worse, and shipping was seriously interfered with by the masses of ice encountered as far down as the mouth of the river.

Under circumstances such as these the month of January, 1891, will long be remembered. Of course the Victoria Steamboat Association had to withdraw their boats, thus stopping all river passenger traffic—the ice floes rendering it impossible—and down to the time of writing it had not been resumed. A number of their floating piers had to be removed from their berths for safety, and barge work was all but suspended.

Otherwise, however, we are glad to report general brisk business all round in our own particular departments.

Shipbuilding

Business is very good and fully maintains last year's activity.

The Thames Ironworks and Shipbuilding Co., Limited, Orchard Yard, Blackwall, have a considerable amount of work in hand, and are employing, at present, about 3,000 hands. They are now finishing H.M.S. *Blenheim*, a first-class cruiser of 9,000 tons, with engines of 20,000 I.H.P. for the British Admiralty. They have, in course of construction, two more first-class cruisers for the English Government, H.M.S. *Grafton* and *Theseus*, both 7,350 tons, the former of which they expect to launch in the course of this year. H M.S. *Blenheim* and her sister ship H M S. *Blake*, now being built at Chatham, will, when finished, be the fastest boats in Her Majesty's Navy, and the only two of their class

At Messrs. Samuda Bros., Limited, Poplar, work is very brisk They have, at present, two protected armour plated cruisers for the British Admiralty—H.M.S. *Sappho* and *Scylla*, both of which ships are well in hand, all the armour plates being in place and both masted. They will shortly be launched, and as all the joiners' work and fittings are ready to go on board, the vessels will not take very long to complete after the boilers and engines are in place. The engines are 9,000 I.H.P. and are to be made by Messrs. John Penn & Sons, Limited, Greenwich. They have also in hand two paddle passenger steamers for the Victoria Steamboat Association of the same construction as the four built by them for the association the year before last; and a third paddle passenger steamer for the same company, only larger, to be used for service between London and Southend. All those vessels are handsomely fitted and should be running by Easter or soon after; the engines for these are also by Messrs. John Penn & Sons, Limited. For the Agent General of the Cape of Good Hope this firm is also building three hopper barges for use in Table Bay Harbour. These are just in frame and all the material is in the works. Messrs. Samuda Brothers are also building two passenger steamers for the South Eastern Railway Co. for service between Port Victoria and Sheerness, and also for excursion traffic from Folkestone to Margate and Ramsgate. These vessels are constructed on a plan rendering them unsinkable with numerous watertight compartments. They are just laid down, and will be engined by Messrs. J. A. Yonng & Sons, of Blackwall. They have likewise a steel dredger in hand for the Indian Government, for use in Burmah. The engines and dredging machinery is being made by Messrs. Hunter & English, of Bow. This goodly amount of work will give employment for some months to come to a considerable number of men, indeed the firm sometimes experiences difficulty in procuring a sufficient number of riveters, platers, caulkers, &c., as so many of these classes of workmen are now employed in London on repair work.

The state of work in progress at Messrs. Yarrow & Co.'s, Poplar, is very good. They have, at the present moment, three sternwheel steamers in hand, two of them for Central America, and one for the Russian Government. The latter will be sent out in ten floatable sections similar to the *Mosquito* and *Herald* gunboats for the Zambezi, which were delivered last year to the Admiralty. This vessel will be 115 ft. over all by 22 ft. beam, and will be put together afloat and have steam up within a week of the arrival of the cargo steamer which will take it out. There is thus a great saving in time and money, for had the vessel been sent out in pieces, four months might elapse before it would have been riveted together and launched. The other two sternwheelers will be rather smaller than the above, and be of Messrs. Yarrow & Co.'s ordinary construction. This firm is also building a first-class torpedo boat for Australia, fitted with triple-expansion engines for a working pressure of 170 lbs. per square inch, and to have a speed of about 24 knots per hour. Two or three second-class torpedo boats are also being built 60 ft. long, which have triple-expansion engines, and the firm's patent tubulous boiler, which they have lately brought publicly forward. The firm are also finishing two 60-ft. handsome steam launches for South American owners. Messrs. Yarrow & Co. have, in addition, several of the Zephyr, or spirit launches, in construction, getting ready for the spring yachting season. These handy little boats are steadily gaining favour with amateur yachtsman.

Marine Engineering.

Business in this department seems also to be in a flourishing condition, but as this is the first start of our Thames Trade Notes we have not had the requisite time to overtake all the establishments we would like to report on; however, as we propose to continue them monthly, we hope, by another issue, to have a more complete report of all branches.

The Thames Ironworks and Shipbuilding Co. are doing a considerable amount of work in this department of their large business. Girder and bridge work bulks largely, while boiler-making is engaging the attention of a large number of hands. Forge work and steam hammers keep all available hands well employed, and altogether the company are looking forward to a very busy year. In their engineering department Messrs. Yarrow & Co., Poplar, are likewise busy. Among other work in hand they have several sets of surface-condensing apparatus, which will be fitted to some high-pressure steamers the firm sent out to Africa two years ago, and which will enable these to navigate the estuaries of rivers on the East Coast of Africa. In the fitting shop may be seen one of their patent tubulous boilers to the order of the Admiralty for a second-class torpedo boat to replace a locomotive boiler which had become worn out. This will enable the boat to have steam up in about 20 minutes, and at the same time increase the speed considerably, although the weight will be 10 per cent. less than that of the boiler it replaces. This new boiler we fully describe and illustrate in another part of this present number. In the works of Messrs. Caird & Rayner, 777, Commercial Road, E., whose speciality is their automatic evaporator, work is plentiful. They have got up a special design for vessels holding passenger certificates, which has been approved by the Board of Trade. It is now being extensively adopted, and the firm begin the new year with many orders on their books, one of them being to fit six or seven steamers of one line with this special design of evaporator. In this type the A size is constructed entirely of copper and gun-metal, with all mountings, including spring loaded safety valve and chest, in gun-metal. They have executed a large amount of copper work lately, in connection with marine work, and are still busy with this work in connection with refrigerating plants for ships, of which they fitted a large number last year, some of the contracts being of considerable magnitude, involving as much as nine tons of copper tubing, and usually had to be executed in very limited time, and it speaks well for the resources of the firm, that in no instance were they behind contract time. This firm seem always to be on the look-out for improvements in the manner of executing their work, and, consequently, their machine tools are of the newest and most approved kind, enabling them to turn out the highest class of work in the most expeditions and economical manner. Were such not the case, they could scarcely turn out the great copper coil we saw, when visiting their works. It contained a third of a mile of tube, and weighed, when complete, about a ton, and was an exceedingly nice piece of work. We understand that Messrs. Caird & Rayner have a considerable number more of these large coils on order.

Electric Lighting.

The Brush Electrical Engineering Co., Limited, have contracts in hand for the supply of complete electric light plant for three large men-of-war, and for the complete electric equipment of two armoured cruisers for foreign Governments. They have also contracts for lighting several passenger vessels, as well as pleasure yachts, in progress. The wiring and fitting of H.M.S. *Sappho* and *Scylla*, now in course of construction in the yard of Messrs. Samuda Bros., Limited, is also to be carried out by the Brush Co.

Messrs. Crompton & Co., Mansion House Buildings, Queen Victoria Street, E.C., are, as usual, busy with installations of electric light, chiefly for town and private purposes, although ship-lighting and electric railways are far from out of their line of business. In our issue of November last we gave a description of the Kensington and Knightsbridge stations constructed by them, and they have also fitted on the same system (the Crompton-Culvert system) stations for Birmingham, Northampton, Southampton, Swansea, Chelmsford, &c., and executed a contract for an electric railway for the Local Board of Southend, which began to run some months ago, and is giving every satisfaction and proving a very paying thing for the Board. The 200 H.P. machines, constructed by the firm and supplied to Birmingham, have developed, we believe, a commercial value up to 96 per cent., a result which should be highly gratifying to the firm, and is one we fancy not yet surpassed. Their works at Lillie Road, Kensington, are, at present, fully employed, and likely to be so for some time to come, and the same may be said of their Chelmsford works.

The Electric Construction Corporation, Limited, have been fully employed in central station lighting, electric traction, accumulators for launches, &c., and since the extension of their Millwall factory, and erection of their large new works at Bushberry, they are now busy in the various branches of electrical engineering, especially as regards the manufacture of large plants for central stations. These they have supplied to the Metropolitan Electric Supply Co., Limited, Chelsea Co., Westminster Co., Brighton Corporation, as well as to Madrid and Melbourne. In electric traction the corporation have completely fitted out a system of 12 cars, which are now running on the Birmingham Central Tramway with great success. In connection with this branch of their business, the corporation have acquired the patents for the Sprague system, and are now prepared to undertake the equipment of the same in districts to which such a system is specially suited. The corporation are also supplying considerable numbers of accumulators, specially constructed for electric launches, to private customers, as well as to the General Electric Power and Traction Co., Limited, who have now a large flotilla successfully at work on the Thames. The manufacture of accumulators receives a great deal of attention from the corporation, and we understand they have just brought out a new type for very high rates of discharge, combined with great efficiency and cheapness. In these new cells the space required per ampère discharge has been reduced to one-half, while the weight is reduced two-fifths, the price at same time being reduced 60 to 70 per cent.

WELSH NOTES.

THE trade of the port of Cardiff continues satisfactory, and the arrivals are above the average. The coal and most of the other staple industries maintain a vigorous tone, and the markets generally characterised by considerable activity. For steam coal there was a good demand, and recent quotations were firmly maintained. Coke manufacturers in this district are busy, and prices are quoted firmly. The pit-wood market was inactive, and owing to the recent large importations, prices had a downward tendency. Good wood was quoted at 15s. 3d. to 15s. 6d. per ton. In the freight market steam chartering was moderately active.

The trade of the port of Swansea has been characterised by great activity. The coal shipments have been above the average. The demand for tinplates continues exceedingly strong, and is likely to remain so for some time to come, and consequently prices have a further upward tendency. Buyers have difficulty in negotiating for May and June delivery except at a price beyond those now current. In New York the tinplate market is very active and strong, and further advances have been made. To show the hopeful feeling prevailing at Swansea, the harbour trust are going to incur a cost of several thousand pounds sterling for additional warehouses for tinplates.

At the monthly meeting of the Newport Harbour Commissioners the question of the improvement and lighting of the Usk was discussed at some length. The Commissioners proposed to acquire a dredger to remove the sandbanks, but Mr. H. J. Parnell, one of the Town Council representatives, wished that the work might be done by contract, as he did not like the responsibility of spending £15,000 or £20,000 on the dredger. Mr. T. Canning thought it very undesirable to let the dredging be done by contract, as it was impossible properly to estimate the cost, and it was a class of work which gave opportunities for making work. Mr. Parnell thought that a sub-committee should be appointed to visit other ports to obtain further information on the subject. Mr. Mordey thought the river could be dredged better by the Commissioners than by a contractor, and Mr. Parnell ultimately withdrew his motion.

The Bristol Docks Committee had under consideration a report from the engineer relating to matters connected with the practical working of the dock estate. These included a new system of dredging by means of hydraulic jets; the fitting upon the *Bull Dog* of further salvage appliances; alterations to the 35-ton crane on the harbour wharf, to make it more suitable for raising boilers from light vessels and masts from vessels; and the provision of hydraulic cranes to the city quays. Ultimately the committee resolved to report to the council in favour of providing a system of hydraulic cranes round the city quays at an estimated cost of about £4,000. With regard to the proposed alteration to the 35-ton crane on the harbour wharf, it was pointed out that the machine was erected twenty years ago, chiefly for the purpose of lifting locomotives made at the Avonside Engine Works. It was resolved that it was not expedient to undertake the work at the present time. The plan of hydraulic dredging by Tydeman's system was approved. The committee also sanctioned the addition of certain appliances to the *Bull Dog*, which will render her still more valuable as a salvage vessel. The Docks Committee has been entrusted by the Town Council to proceed with the construction of graving and coaling docks at Avonmouth to cost upwards of £125,000. The works were recommended when the tonnage was 600,000 tons, while last year it was 625,000 tons.

BELFAST TRADE NOTES.

TRADE here still maintains the activity which has continued so long, and with every prospect of the same continuing for a considerable time.

Messrs. Harland & Wolff had the trial trip of the s.s. *British Crown* on 17th January, which was most successful, the steamer immediately leaving for Swansea. This steamer has been built to the order of the British Shipowners' Co., Liverpool, and will be engaged on the London, Baltimore, and Philadelphia trade.

The s.s. *Texas* is under repairs and alterations, and they had also in hands during the month the s.s. *Black Head* and s.s *Lord Lansdowne* for repairs.

Messrs. Workman, Clark & Co., Limited, Belfast shipyard, handed over to her owners the s.s. *Helen Craig*, also a new steam ferry for the harbour, and the s.s. *Eveleen*, recently launched by them, was towed to Glasgow to receive her machinery.

Messrs. V. Coates & Co. had the s.s. *Dunmore Head* and also s.s. *Teelin Head* in hand for repairs, and are pretty busy at present.

Messrs. McIlwaine & Maccoll, Limited, launched on the 3rd January the new s.s. *Manchester* for the new line between Belfast and Liverpool and to Manchester, when the canal to that place is opened.

They had also in hand for repairs during the month the s.s. *City of Hamburg*, s.s. *Titanic*, and s.s. *Strait Fisher*.

The paddle steamer *Princess Louise*, formerly on the Larne and Stranraer route, but which since the arrival of the new steamer has been lying in the Spencer Basin here, has been sold, we understand, to Mr. David McBrayne, Glasgow.

LEITH NOTES.

DURING the past month, business in all departments of trade was very quiet owing to the utter breakdown of mineral traffic here, consequent on the railway strike. The shipments from all the ports on the Firth of Forth were practically stopped, and a holiday was in some instances necessary. Most of the collieries in Midlothian and the west of Fife have been stopped for want of railway communication, and, should the present state of things continue, a great loss to collieries, shippers, and others will be the result. The dockers, acting for the railway men, have refused to unload shipments of Scotch coal to Scotch ports where such a proceeding has been tried. At Granton, no coal was shipped for the first week of January, but an attempt is now being made to do some trade, though under considerable difficulty. It is very difficult to form any opinion as to how things are progressing, as the strikers maintain that traffic is almost entirely suspended, while the railway companies state that they are experiencing hardly any inconvenience. There is, however, no doubt that the trade from the ports on the Firth is suffering very severely, and it is to be hoped that an early settlement will be arrived at.

The total coal shipment at Methil during the past year has been 666,403 tons, as compared with 556,040 tons in 1889, and 410,131 tons in 1888. These returns show very decidedly that Methil will shortly become one of the largest coal exporting ports in the east of Scotland.

The Grangemouth Dockyard Company have just taken possession of their recently acquired shipyard at Ardrossan. They have already received orders for three new vessels, the keel blocks of two of which have now been laid. During the past year this company launched about 18,000 tons of new shipping on the Forth, and they intend to do their best to have an equal output at Ardrossan.

Mr. T. Caxton Fidler, M.I.C.E., of London, has been appointed Professor of Engineering at University College, Dundee, the vacancy occurring through the appointment of Professor Ewing to the Chair of Mechanics at Cambridge.

MAIL SHIPS.—In the House of Commons, on the motion of Sir J. Fergusson, leave was given to introduce a Bill to enable her Majesty in Council to carry into effect conventions which may be made with foreign countries respecting ships engaged in postal service, and the Bill was read a first time.

INCREASED BOILER PRESSURE AND INCREASED PISTON SPEED FOR MARINE ENGINES.*

BY WILLIAM RUSSELL CUMMINS.

(*Continued from page* 446.)

AT the end of the first stage a certain amount of the condensed steam will have been evaporated by the heat contained in the cylinder walls, and will be available for doing work. It is, however, at a lower temperature than the initial steam, and therefore has less potential energy. By dividing the period of expansion into a sufficient number of stages, and adding up the available energy of each portion of steam as it gets re-evaporated, and comparing the total thus obtained with the available energy of 2 lbs of steam for the total temperature, an idea of the loss due to condensation between the assumed limits may be obtained.

Condensation in the cylinder may be prevented by means of a steam jacket, but no economy can be effected thereby. Suppose a certain quantity of steam at 100 lbs. pressure, containing 200 thermal units, be admitted to an unjacketed cylinder, and assume that the walls of the cylinder absorb 100 thermal units, a certain amount of energy will be extracted from the remaining 100 thermal units, and also a certain portion of the heat stored up in the cylinder walls, will, as expansion proceeds, become available for doing work.

Next, suppose the cylinder to be jacketed with steam of 100 lbs. pressure. If no steam be condensed on entering the cylinder, it follows that the walls must have absorbed 100 thermal units from the steam in the jacket.

In the one case 200 thermal units have been put into the cylinder and 100 thermal units into the jacket, up to the point of cut off: and in the other case (to secure equal conditions, viz., 200 thermal units at initial temperature at point of cut off), 300 thermal units are put into the cylinder direct, the result being the same in both cases. Thus no economy can result from the use of a jacket, but it may be very convenient in cases of great ratios of expansion to prevent flooding of the cylinder. It must not be forgotten that the jacket is also transmitting heat to the steam and water in the cylinder during the period of expansion. If the steam in the cylinder has no water mixed with it at the beginning of the expansion the jacket will prevent liquefaction due to expansion, or it may possibly superheat the steam. This transmission of heat from a higher to a lower temperature involves a loss. Suppose, for example, that 100 thermal units were transmitted to the steam in the cylinder during the period of expansion, by jacket steam. The amount of loss in this case is measured by the difference in the efficiency of 100 thermal units at 100 lbs. pressure and 100 thermal units at some temperature *lower* than this. This argument also applies to all cases where steam of a higher pressure gives up heat to steam of a lower pressure, as happens between the steam and exhaust side of a slide valve, and also where exhaust steam is in contact with the cylinder walls.

The next question which arises is, what is the action of condensation as effected by division of temperature range by passing the steam successively through two or more cylinders? For the means of comparison let us take as examples a simple engine and a compound; the low-pressure cylinder of the compound being of the same capacity as the single cylinder of the simple engine. For convenience let it be assumed that in the case of the compound engine the same amount of steam is condensed in each cylinder. Suppose, for example, that 4 lbs. of steam are admitted to the high-pressure cylinder, of which 1 lb. is condensed up to the point of cut off. Assume that this pound of water will be re-evaporated by the end of the stroke. The steam is then admitted to the low-pressure cylinder, and 1 lb. of it condensed up to the point of cut off, the water, as before, being re-evaporated by the end of the stroke.

This process can be represented by a diagram (see Fig. 2.). Let horizontal ordinates represent weights of steam, and vertical ordinate temperatures. A C will represent the 3 lbs. of steam present at the point of cut off in the high-pressure cylinder. For the sake of simplicity let it be assumed that the re-evaporation of the condensed steam follows the line C F, so that in the high-pressure cylinder the amount of loss may be represented by the triangle C B F, and similarly in the low-pressure cylinder by the triangle E F J, so that the total loss may be indicated by the rectangle E F J H. Now, what will happen in the case of the simple engine? The surface for condensation will be, roughly, about one-fourth less than before, owing to the earlier cut off; but it is raised through twice the temperature.

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* Read before the North-East Coast Institution of Engineers and Shipbuilders.

Under these conditions it is probable that more than 1 lb. of steam will be condensed, say, for example, an equal amount to K B. Then the loss will be represented by the triangle K J B, and the double cylinder will be more economical by the value of the triangle K J C. Of course there are no grounds for assuming that the re-evaporation takes place as indicated here, but it will serve to show why an economy should result from divided temperature range.

(To be concluded in our next.)

Mersey Docks and Harbour Board.—The Mersey Docks and Harbour Board have deposited a Bill in the Private Bill Office of the House of Commons, under which powers are sought to improve the docks, basins, and works at the northern end of their Liverpool Dock Estate, "in order," says the preamble, "to meet the requirements of the trade of the port, and having regard to the increased and increasing size of vessels frequenting the port." By clause 3 of the Bill powers are sought to deepen part of the Canada Basin, to lengthen and deepen the Canada Lock, and construct a pier or jetty near thereto; to reconstruct the existing passages between the Canada and Huskisson Docks; to lengthen and deepen the Eastern Huskisson Lock; and to deepen a portion of the navigable waterway on the eastern shore of the river Mersey. The Bill also seeks power to construct a new dock near the north-eastern corner of Huskisson Dock, a new graving dock near the northern end of the Western Huskisson Lock, and a half-tide dock upon the sites of Sandon Basin and Wellington Half-tide Dock. The time asked for within which to complete these works is ten years from the passing of the Act, while for their construction powers are sought to borrow, on the security of the rates for the time being belonging to them, any further sum not exceeding £1,000,000. The Bill also asks Parliament to confirm the construction, for raising the level of the water in certain docks, &c., of pumping apparatus and the abstraction, by means of such pumps, of water from the river Mersey; and further proposes to sanction an extension of this method of abstracting water from the river for supplying all or any of their docks, basins, or works with water.

New Foreign Canals.—The *Temps* publishes some extracts from a report recently drawn up by the Austrian engineer, Herr Deutch, who had been commissioned to inspect the works in progress, and to give an estimate of the time and cost of completing them. The original calculation was that there would be, exclusive of the dredging of the ports at each end, 9,500,000 cubic metres of soil to be excavated throughout the length of the canal, from the Gulf of Corinth to the Bay of Egina, and in July, 1889, the total excavated amounted to 8,200,000 metres. But it was then found that the slope of the banks (one foot in ten) would not be gradual enough to prevent the soil from slipping, and that, while it would be necessary to excavate another 2,000,000 cubic metres, it would also be necessary to do 195,000 cubic metres of masonry work, facing the banks with 6 ft. of stone or brick, for a length of more than 2¼ miles. This was what led to a temporary suspension of the works, but additional capital has since been subscribed, and Herr Deutch reports that the main portion of the work has now been done. The question, however, is whether the facing of the banks will be sufficient to insure the stability of the work, and this can only be proved by experience, the fear being that the contact of the marl with the water will cause it to crumble and slip away into the canal. The *Temps* also gives some interesting particulars, supplied by M. Tanabé, the chief engineer of the Kioto Canal in Japan, which has been dug between Lake Biwa and the Bay of Osaka. This canal, which is about seven miles long, carries the waters of Biwa, a lake of 500 miles square, and at an altitude of 275 ft., to the town of Kioto, and it is not only used for navigation, but it supplies motive power for factories and irrigates the rice-fields. The canal is carried through the mountain chain known as Nogaro-Yama, in a tunnel about a mile and a half long, and this tunnel has been cut through and faced in the European style, under the superintendence of a French engineer. There are two shorter tunnels nearer to Kioto, and to reaching that town the canal is divided into two branches, one being navigable and forming a junction with the old canal which has previously existed between Kioto and the sea, while the water in the other branch supplies motive power to the engines in the Kioto factories.

Steam Communication between Great Britain and Tunis.—In 1886 Mr. Sandwith, the British Consul in Tunis, reported on the advantages which would accrue from direct steam communication between England and that country. He pointed out that British commerce is subject not only to the cost and risk of transhipment at Malta, but to a delay which cannot amount to less than twice the time required for a direct passage from England, and it is, therefore, not to be wondeder at if foreign nations are driving British products out of the market. The present British Consul in the Regency in his last report returns to the subject, and says that British goods, with the exception of cottons, are being gradually supplanted by German, Austrian and Belgian products, most of which have to bear transit expenses to Marseilles or Naples before shipment to Tunis. It stands to reason, therefore, that regular steamship communication between Great Britain and Tunis would enable the British exporters to compete successfully with foreigners in such goods as cottons, woollens, colonial produce, hardware, machinery, iron, coal, &c. Return freights would be available of esparto, corn, oil, hides, and wool; but ships touching at Tunisian ports should not be entirely dependent, at the outset, on freights to and from Tunis, but should belong to a company engaged in the Mediterranean shipping trade, which would undertake to include Tunis in their itineraries. At present regular communication with the chief ports of Tunis and Marseilles is kept up by steamships belonging to the Compagnie Générale Translantique and the Société Générale de Transports Maritimes, and with Italy by the Florio and Rubattino Co.s' ships. The latter line and the Translantique are respectively subsidized by the Italian and French Governments for the conveyance of mails. The Danish Limited Steamship Co.'s vessels also touch at Goletta once a month, on their way from Copenhagen and Antwerp to the East. British ships usually arrive with cargoes of coal or iron, and obtain return freights of esparto grass from Susa and Sfax, but, with the exception of the few vessels that call for esparto grass, British shipping is insignificant.

American Ship Railway Schemes.—The engineers have completed their surveys of the routes of the proposed ship railways. It is estimated that it would cost 10,000,000 dols. and 30,000,000 dols. respectively to convert Toronto and Chigago into seaports. The reports will be laid before a meeting of the promoters at Montreal next week. The project involves the deepening of the St. Lawrence Canal, so as to allow ocean vessels a 25 ft. draught. The Minister of Marine lately said that he hoped soon to see Toronto a seaport, which is interpreted to mean that the Dominion Government considers the project at least feasible.

The Position of Basic Steel in England.—At the last meeting of the Cleveland Institute of Mining Engineers, held last month, an interesting discussion on the present attitude of the Admiralty, Lloyd's Register, and the Board of Trade towards steel made from native phosphoric ores by the Thomas-Gilchrist or basic process took place. Mr. Gilchrist explained the attitude which the French, Belgian, Austrian, German, and Russian authorities adopted towards the process; he stated that basic open-hearth steel was freely accepted by the naval authorities of those countries upon the same terms as that made from hematite ores. He pointed out that by the displacement of the 4,000,000 tons of foreign ores at present used by our native ores (from which equally good steel is obtained) we should not only be helping our native iron ore industry by requiring some 5,000,000 extra tons of ore per annum, but we should be rendering ourselves independent of foreign supplies, which would be a matter of enormous importance in case of war. Mr. W. H. White, Director of Naval Construction, spoke in reference to the position taken by the Admiralty in the matter. Extensive experiments were, he said, at present being carried out, and until the results of these were known, basic steel was admitted by the Admiralty authorities in all cases in which acid Bessemer steel was at present allowed. The Admiralty were using basic steel rivets largely in shipwork, and with excellent results; the engineering department were also using basic plates of low tensile strain. Mr. Milton, chief engineer of Lloyd's Register, said that Lloyd's by no means wished to throw cold water upon basic steel. At present certain works were manufacturing basic steel for shipbuilding purposes under Lloyd's tests, and had been doing so for the past three years, and they were fully prepared to allow other firms to do the same provided Lloyd's were first satisfied that the steel made by each individual firm was both regular and good in quality.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Skuld.—On December 22nd there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, a steel screw steamer, built to the order of Mr. Otto Thoresen, of Tonsberg, Norway. The principal dimensions are:—Length, 237 ft.; beam, 33 ft.; depth, moulded, 18 ft.; with a deadweight capacity of 1,800 tons. The vessel is constructed on the raised quarter-deck system, with cellular double bottom, all fore and aft, and will take the highest class at Lloyd's and also Norwegian Veritas. The cabins are arranged in a large house on the bridge deck; accommodation is provided for engineers and officers under the after-end of the bridge, and for crew in topgallant forecastle. Steam and hand steering gear fitted on flying bridge, and hand gear in wheelhouse aft. During construction the vessel has been superintended, on behalf of the owner, by Captain Rafen, who will take command of her. The engines have likewise been built to Lloyd's and Norwegian Veritas requirements by the North-Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, and are on the triple-expansion principle, having cylinders 17 in., 28 in., and 46 in., with 33 in. stroke, capable of indicating 700 H.P., and propelling the ship at a speed of 9½ knots loaded. As the vessel left the ways she was named the *Skuld* by Miss Jessie A. Skinner.

Surrey.—On December 23rd there was launched from the yard of Messrs. John Blumer and Co., Sunderland, the screw steamer *Surrey* built to the order of E. R. Ray, Esq., of Hendon, Lansdale, Sunderland, and Old Sun Wharf, London. The principal dimensions of the vessel are:—Length, 190 ft.; beam, 30 ft.; depth, 15 ft. The *Surrey* is to be fitted with engines of the triple-expansion type, having cylinders 16½ in., 26½ in., and 43½ in., with a stroke of 30 in.

Tyr.—On December 23rd there was launched by Messrs. J. L. Thompson & Sons, at Sunderland, a steel steamer built to the order of Mr. Jacob R. Olsen, of Bergen. The vessel is of the following dimensions:—Length between perpendiculars, 290 ft.; breadth, 38 ft. 6 in.; depth, moulded, 22 ft. 3 in., with a deadweight capacity of 3,600 tons. The engines are of the triple-expansion type, with cylinders 21½ in., 35 in., and 58 in. respectively, with a stroke of 39 inches. The vessel was named the *Tyr*.

Steel Screw Steamer.—On Tuesday, December 23rd, Messrs. Sir Raylton Dixon & Co. launched from their No. 2 Dockyard, Middlesbro', a steel screw steamer, "No. 331," of the following dimensions:—Length over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a deadweight capacity of about 3,300 tons at 19 ft. 7 in. This vessel has been built on the web-frame principle with poop, raised quarter deck, long bridge, and topgallant forecastle. Her engines will be fitted by Messrs. Blair & Co., Limited, Stockton, having cylinders 21 in., 35 in., 57 in. by 39 in. stroke.

Priok.—On December 24th Messrs. C. S. Swan & Hunter launched from their west yard the steel screw steamer *Priok*, sister vessel to the *Tosari* and *Lawang*, built for the same owners, Messrs. The Deutsche Dampfschiffs Rhederei of Hamburg, for their newly-inaugurated Sunda line from Hamburg and Rotterdam to Java and adjacent ports. The vessel is 312 ft. over all, by 41 ft. by 24 ft. moulded depth, with long full poop and long bridge, the bridge and poop being connected by a wide house with extended deck to side, and sumptuously fitted up for first-class passengers; handsome music saloon with stained-glass windows and dome-top skylight, also smoking saloon fitted in marble and india-rubber tiled floor. Topgallant forecastle for crew and petty officers, electric light throughout, and all the most modern improvements. Engines by the Wallsend Slipway & Engineering Co., capable of indicating 2,500 I.H.P. The vessel will have the highest class at Lloyd's, built under special survey and in accordance with the German laws. She was named by Miss Hunter. The sister vessel *Tosari* went out on her trial trip on Saturday, 20th December, and after a satisfactory run proceeded to Hamburg.

Rising Hope.—On December 24th a sloop was launched from the shipbuilding yards of Mr. Richard Dunston, at Thorne. The vessel was named the *Rising Hope*. Her dimensions are:—Length, 50 ft. on keel; beam, 15 ft.; height, 5½ ft.

Cereda.—On December 24th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a steel screw steamer of the following dimensions, namely:—Length, 290 ft.; breadth, 40 ft. 6 in.; depth, moulded, 22 ft. 3 in. The vessel is of the raised well-deck type, having poop, long extended bridge, raised quarter-deck, and topgallant forecastle. The steamer is provided with cellular bottom for water ballast, is fitted for the grain and general cargo trades, and is classed 100 A 1 at Lloyd's. The machinery consists of triple-expansion engines, having cylinders of 23 in. 37½ in. and 61½ in. diameter, with a stroke of 39 in and two large steel boilers, working at a pressure of 160 lbs. to the square inch. The steamer has been built to the order of Messrs. Cay, Hall, & Partners, Limited, and will be registered at South Shields. She will carry 3,800 tons, on a draught of 20 ft. The vessel was named the *Cereda* by Miss M. E. Robinson, of Wellington Terrace, South Shields.

British King.—On December 24th there was launched from the Jarrow Yard of Messrs. Palmer & Co. a large screw steamer of the following dimensions, viz.:—Length, between perpendiculars, 405 ft.; breadth, moulded, 47 ft. 6 in.; depth, moulded, 30 ft. 9 in. The vessel has been built under special survey to class 100 A Lloyd's, and is of the three-deck type, with a poop, bridge, and topgallant forecastle. Steel upper and main decks are fitted all fore and aft, and the frames are sheathed with pitch pine, and accommodation for the officers and engineers is provided amidships. The poop is fitted with accommodation for the crew. A cellular double bottom for water ballast is fitted all fore and aft. Complete set of wood shifting boards and grain hatches in 'tween decks are fitted suitable for grain cargoes. The 'tween deck is provided for sidelights, and special arrangements have been made for ventilation, &c., suitable for the cattle trade. The vessel is fitted with a Clarke-Chapman direct steam windlass and a steam steering engine aft, and is fitted with all the latest improvements.

Kintuck.—On December 26th Messrs. Sir Raylton Dixon & Co., launched a very fine steamer which has been built to the order of the China Shippers' Mutual Steam Navigation Co., Limited, of London, and intended to form one of their line of steamers for the tea trade. This vessel is one of the largest and handsomest steamers yet built on the Tees, with very fine lines and large power so as to attain a speed of 14 knots per hour. Her dimensions are:—Length over all 373 ft. 6 in.; breadth, 45 ft.; depth, moulded, 30 ft. 3 in.; her gross register tonnage about 3,700, and she will carry about 5,000 tons of tea. Her decks are entirely of teak, and she is fitted with very ornamental saloon and passenger cabins on house amidships. The engines are by Messrs. T. Richardson & Sons, of Hartlepool, with cylinders 32 in., 49 in., and 77 in., having a stroke of 4 ft., and will give an indicated power of nearly 3,000 horse. A powerful steam windlass by Emerson, Walker & Co. is supplied. Before leaving the ways this vessel was christened the *Kintuck* by Miss Inga Raylton Dixon, the youngest daughter of the builder, and is the last ship Messrs. Dixon launched last year, making a total tonnage of 43,665 gross register for the 12 months.

Sophia Couppa.—On December 26th Messrs. Craig, Taylor & Co. launched from their Thornaby shipbuilding yard, Stockton-on-Tees, a handsomely-modelled steel screw steamer, of the following dimensions:—292 ft. by 37 ft. by 20 ft. 3 in. The vessel has been built with a long raised quarter-deck, bridge extending to and including foremast and fore-winch, short well and topgallant forecastle. She is built on the web-frame principle, and has double bottom for water ballast all fore and aft, and in peaks for about 600 tons. She will be fitted with four steam winches and Pepper's steam steering gear by Robert Roger & Co., Stockton; patent windlass, by Emerson, Walker & Thompson Bros., Gateshead; light-houses, Hastie's screw gear aft, and all modern improvements, so as to admit of rapid loading and discharging. The engines, on the triple-expansion three-crank system, are being constructed by Messrs. Blair & Co., Stockton, and are of the following sizes:—21 in., 35 in., and 57 in. by 39 in. stroke; two large steel boilers 160 lbs. pressure. The vessel has been built to the order of Messrs. Vagliano Bros., of London, for Messrs. Couppa & Co., of Marseilles, for their Mediterranean trade, and has been superintended by Mr. William Law, consulting engineer, of Liverpool. As she left the ways she was gracefully christened the *Sophia Couppa* by Miss Daisy Barugh, daughter of Jasper Barugh, Esq., National Provincial Bank, Stockton.

Taurus.—On Friday, December 26th, Messrs. W. Gray & Co., Limited, launched the fine screw steamer *Taurus*, which has been built to the order of Mr Wilh. Wilhelmsen, of Tonsberg, Norway. The vessel will take Lloyd's highest class. Her dimensions are, length over all, 288 ft.; breadth, 37 ft. 2 in.; depth, 21 ft. 2 in. The deck erections consist of poop, raised quarter-deck, long bridge, topgallant forecastle, and two large deck-houses. The saloon and cabins are fitted forward of the boiler-casing in one of the large deck-houses, and the engineers' rooms in the other house, which is on the quarter deck, while the crew's accommodation is in the forecastle. The hull is built on the web-frame system. Large hatchways are fitted, four steam winches, steam steering geer amidships, screw gear aft, large donkey boiler and patent direct steam windlass, boats on beams overhead, two masts with fore-and-aft rig, and all modern working appliances will be fitted for general trading. The Central Marine Engine Works of W. Gray & Co., Limited, supply fine triple-expansion engines having cylinders 21½ in., 34 in. and 57 in. diameter, with a 39-in. piston stroke and two large steel boilers to work at 160 lbs. pressure per square inch. The ship has been superintended during construction by Messrs. Noble & Buckle, of Newcastle, on behalf of the owners. The ceremony of christening the *Taurus* was gracefully perormed by Mrs. Wold, wife of Captain Wold, commander of the *Taurus*.

Calcutta City.—On December 27th Messrs. Ropner & Son launched a steel screw steamer of the following dimensions:—Length, over all, 324 ft.; breadth, 40 ft. 6 in.; depth, moulded, 23 ft. 7 in. This steamer has been built under special survey to class 100 A 1 at Lloyd's, to the order of Mr. C. Furness, of West Hartlepool. She has a short full poop, in which is fitted accommodation for captain and officers, a raised quarter-deck, short well, and topgallant-forecastle; cellular bottom for water ballast. She is built on the web-frame principle, and, having very large hatches, is well adapted for carrying heavy cargoes. She will have four steam winches, two donkey boilers, Davis's steam steering gear, Hastie's screw gear aft, Emerson, Walker & Co.'s direct steam windlass, &c., and all the latest improvements for a first-class cargo steamer. Her engines are by Messrs. Blair & Co., of 950 H.P., with two steel boilers working at 160 lbs. She was christened *Calcutta City* by Miss Tate, of Stockton. This is the fifth steamer built by Messrs. Ropner & Son for the same owner.

Buckingham.—On December 27th Messrs. W. Gray & Co., Limited, completed their launching programme for the year 1890 by launching the fine steel screw steamer *Buckingham*, which has been built to the order of Mr. Christopher Furness, of West Hartlepool, for Messrs. Raeburn & Verel, of Glasgow. The dimensions of the vessel are:—Length over all, 324 ft.; breadth, 40 ft. 6 in.; depth, 23 ft. 8½ in.; and deadweight capacity about 4,350 tons; she will class 100 A1 at Lloyd's, and the deck erections consist of poop, long raised quarter-deck, long bridge, and topgallant forecastle. The saloon, state-rooms, and captain and officers' rooms will be aft. The engineers' accommodation amidships, and that for the crew in the forecastle. The hull is built with web frames, and a cellular double bottom throughout for water ballast. A complete equipment will be provided, including two donkey boilers, steam winches, steam steering gear, screw gear aft, patent windlass, by Emerson, Walker & Co.; patent stockless anchors, boats on beams overhead, and two masts with fore double topsails. The Central Marine Engine Works of W. Gray & Co., Limited, supply the engines, which are of the triple-expansion type, of 1,300 H.P., and two large steel boilers to work at a pressure of 160 lbs. per square inch. She was christened *Buckingham* by Professor Pettigrew, of St. Andrew's University.

Mossoro.—On December 29th there was launched from the shipbuilding yard of Messrs. R. & W. Hawthorn, Leslie & Co., Hebburn, this screw steel steamer for foreign owners, of the following dimensions:—Length, over all, 215 ft.; breadth, 31 ft.; and depth, 15 ft. The vessel will be supplied with triple-expansion engines with a working pressure of 160 lbs. The vessel is intended to carry a large cargo on a light draught of water, and is specially adapted for ascending shallow rivers.

Kitty.—On December 31st there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, a steel-screw steamer, built to the order of Mr. Thos. B. Olsen, of Christiansand, Norway. The principal dimensions are:—Length, 225 ft.; breadth, 30 ft.; depth, 16 ft. 6 in., moulded. She is of the long-raised quarter-deck type, and has [illegible] built under special survey for Lloyd's 100 A1 classification, [illegible] that for Norwegian Veritas highest class. The engines have also been built to Lloyd's and Norwegian Veritas requirements by the North-Eastern Marine Engineering Co., Limited, Wallsend. They are on the triple-expansion principle, having cylinders 17 in., 28 in., and 46 in. by 30 in. stroke. She is also fitted with Emerson, Walker & Co.'s patent windlass. The ship was christened the *Kitty*.

Dunmurry.—On January 8th Messrs. Short Bros. launched at Pallion a steel-screw steamer for Messrs. Boyd Bros. & Co., Limited, of Belfast. Her principal dimensions are:—Length, 293 ft.; breadth, 39 ft.; depth of hold, 27 ft. 6 in. to ordinary floor. The vessel was named *Dunmurry*, and is to be fitted with triple-expansion engines by Messrs. T. Richardson & Son of Hartlepool, and Emerson, Walker & Co.'s windlass.

Steam Trawlers.—On January 8th there was launched from the building yard of Messrs. Hepple & Co., North Shields, an improved design of a first-class ocean-going iron screw-steam trawl fishing boat. Dimensions:—102 ft. by 19 ft. 3 in. by 11 ft.; 300 I.H.P.; speed, 11 knots, with all latest improvements. She has been built to the order of Captain Young, of Preston, North Shields. A similar vessel was launched on the 10th from the same yard, and the firm hope to launch eight similar vessels within the next six months.

Cairnie.—On January 8th there was launched from the yard of the Blyth Shipbuilding Co., Limited, Blyth, a screw steamer, built to the order of Mr. W. Todd Moffatt, of Aberdeen. The steamer is to carry about 260 tons, and is intended for the coasting trade. She will be towed from Blyth to Aberdeen to receive her engines and boilers, which are being constructed by Messrs. Blaikie Bros., of Aberdeen. The ceremony of naming the steamer *Cairnie* was gracefully performed by Miss S. Day, of North Shields. The Blyth Shipbuilding Co. has also several new vessels on the stocks in various stages of progress, and their graving dock is at present filled by a Hartlepool steamer. In addition to these, the company is engaged with the extensive repairing of several steamers at their quay and in the river.

Cragg.—On January 8th there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay, on Tyne, a steel screw steamer built to the order of Messrs. Fisher, Renwick & Co., of Newcastle, and of the following dimensions, viz.:—Length 180 ft., breadth 28 ft., depth 14½ ft. and to class 100 A 1 at Lloyd's. This vessel has water ballast, and is also fitted with all modern improvements for the rapid loading and discharging of cargo including three double cylindered steam winches, windlass, by Emerson, Walker & Co.; large donkey boiler, steering gear amidships by Messrs. Davis & Co., Limited, and Hastie's screw gear aft. The engines, which are to be supplied by the North Eastern Marine Engineering Co., Limited, are of the triple-expansion type, having cylinders 13½ in., 22½ in. and 36 in. by 27 in. stroke and working at a pressure of 160 lbs. On leaving the ways the vessel was gracefully named the *Cragg* by Miss Bessie Lewis, of Cardiff.

Ben Wyvis.—On January 10th there was successfully launched from the yard of Messrs. Robert Thompson & Sons, Southwick Yard, Sunderland, a steel screw steamer built to the order of Messrs. J. & A. Davidson, of Aberdeen, and is intended for the Baltic and Mediterranean trade. The dimensions are:—Length between perpendiculars, 205 ft.; breadth, 31 ft.; depth, moulded, 15 ft. 9 in.; class, 100 A 1 at Lloyd's. Gross tonnage (about) 910 tons. The vessel is constructed with raised quarter-deck, bridge over engines and boilers, and top-gallant forecastle. Water ballast is fitted in after and main holds and both peaks. Cabin accommodation is fitted up at fore-end of bridge for captain and officers' engineers on each side of after-end of bridge; sailors and firemen in forecastle. Three very large hatchways with steam winch to each hatch, and large donkey boiler, direct-acting steam windlass-steam steering gear, &c. The vessel is rigged as fore-and-aft schooner and has been fitted with all the most modern improvements for facilitating rapid loading and discharging, and during construction has been superintended by Captain Davidson. The engines are by the North Eastern Marine Engineering Co., Limited, of Sunderland, of the triple-expansion type, with cylinders 16½ in., 26½ in. and 43½ in. by 30 in. stroke, and boiler of 160 lbs. pressure. On leaving the ways she was gracefully christened the *Ben Wyvis* by Miss Newton, daughter of George Newton, Esq., of the Wearmouth Coal Co., Limited, Sunderland.

Rio Formoso.—On January 10th Messrs. Wigham Richardson & Co. launched from their Neptune Shipyard, Low Walker, a twin-screw steamer, which has been built to the order of

Wm. Blackburn, Esq., of Liverpool, representing the Companhia Pernambucana, of Pernambuco, and is intended for coasting service in South America. The vessel is built of steel, under special survey, to class 100 A1 in Lloyd's Register, and is rigged as a schooner with two pole masts. The engines are also constructed by Messrs. Wigham Richardson & Co., and consist of two sets, triple-expansion type, suitable for driving the vessel at a good speed in shallow waters. The vessel is fully equipped with auxiliary machinery, including steam winches, steam windlass, donkey boiler, and other necessary appliances. The construction of the hull, outfit, engines and boilers is proceeding under the superintendence of Mr. H. F. Moore, of Liverpool. As the vessel left the ways she was named the *Rio Formoso* by Mrs. Fletcher, of Penrith.

Chatfield.—On January 12th Messrs. Irvine & Co., of West Hartlepool, launched the steel screw steamer *Chatfield*, 314 ft. by 40 ft. 6 in. by 23 ft. 8 in., to the order of Mr. C. Furness. The vessel has been built to Lloyd's highest class, and has a deadweight carrying capacity of about 4,330 tons. The engines are of the triple-expansion type, and are being supplied by Messrs. T. Richardson & Sons.

Pendragon Castle.—On January 12th Messrs. R. Williamson & Son launched at Workington a large sailing vessel for Messrs. James Chambers & Co., of Liverpool. Dimensions:—Length, between perpendiculars, 293·6 ft.; breadth, 42 ft.; depth from top of ceiling, 24 ft. 6 in.; nett register, about 2,460 tons; deadweight capacity, 3,800 tons. She has been built under special survey to class 100 A1 at Lloyd's, and was named the *Pendragon Castle*.

Minnie.—On January 17th the fore-and-aft schooner yacht *Minnie* was launched from the yard of Mr. W. H. Whear, at Hayle. The *Minnie* has been built to the order of Mr. J. G. Osborne, of Hayle, for a private gentleman in Sunderland.

Sledmere.—On January 24th Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length, B.P., 270 ft.; breadth, extreme, 36 ft. 6 in.; depth, moulded, 19 ft. 1½ in.; tonnage, gross, about 1,930 tons. This vessel, which has been built to the order of Messrs. G. R. Sanderson & Co., of Hull, is classed 100 A1 at Lloyd's, and has been built under special survey. She has a raised quarter-deck from stem to after engine-room bulkhead, and a partial awning-deck from after engine-room bulkhead to stern. The engineers and officers are berthed in a deckhouse aft; captain and saloon in a deckhouse amidships, the accommodation for crew being in 'tween decks forward, at cellular double bottom for water, ballast is fitted fore and aft, the fore-and-aft peaks being also utilised as ballast tanks. The vessel will be supplied with four steam winches, large donkey boiler, steam steering gear, stockless anchors, double derricks and all modern appliances for speedy loading, discharging, and manœuvring. The engines are by Messrs. Blair & Co., Limited, Stockton, cylinders 20½ in., 33½ in. and 55 in. by 36 in. stroke, 160 lbs. working pressure. As the vessel was leaving the ways she was christened *Sledmere* by Miss Robertson, of Leytonstone, Essex.

Wildcroft.—On Saturday, January 24th, Messrs Edward Withey & Co. launched from their yard at Hartlepool a large steel screw steamer, built to the order of F. Woods, Esq., London. She is a fine type of a modern cargo boat, measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge house, and a topgallant forecastle. The holds are fitted with iron grain divisions, and iron cargo battens; all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors hauling up into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin, providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted-fore-and aft schooner. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. She was gracefully christened *Wildcroft* by Miss Mollie Sivewright.

Braunfels.—On January 26th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, the tenth steamer built by that firm for the Hansa Steamship Co., of Bremen. The length of the vessel is 243 ft.; breadth, 41 ft.; and depth of hold, 27 ft. 6 ins. The vessel is built to the spar deck rule, and has large topgallant forecastle to accommodate crew and firemen, and long bridge amidships, under which is placed the saloon and accommodation for captain, officers, and a few first-class passengers. The vessel is constructed upon the web-frame principle, thus dispensing with hold beams, and has cellular water ballast all fore and aft, all weather decks are of teak, and all frames of Z steel, her class will be 100 A1, Lloyd's special survey, and also the highest class in the German Registry. The deck machinery consists of five large steam winches and direct steam windlass by Messrs. Clarke, Chapman & Co., Messrs. Donkin & Nichol's steam steering gear, which is placed in the engine-room and worked from the bridge, Tyzack's patent anchors, and all the usual appliances for handling cargo and working the ship with the greatest possible dispatch. The main engines are upon the tri-compound principle, by the Wallsend Slipway and Engineering Co., Limited, Wallsend, and have cylinders 23½ in., 39 in., and 64 in. by 42 in. stroke, steam being supplied by two large steam boilers working at a pressure of 160 lbs. per square inch. The vessel during construction has been inspected on behalf of the owners by Mr. Wulff and Mr. Himer, and upon leaving the ways was gracefully named *Braunfels* by Miss Kaven, of Kiel, after which she was towed to the Tyne to receive her machinery.

LAUNCHES.—Scotch.

Skjold.—On December 24th Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a three-masted barque named *Skjold*, of 1,500 tons register, capable of carrying 2,500 tons deadweight. Dimensions:—Length, 250 ft.; breadth, 38 ft.; depth, 21 ft. 6 in. This vessel is built to Lloyd's highest class and Norwegian Veritas. The owners are Messrs. A. & F. Smith, Tvedestrand, Norway. The vessel was superintended during construction by Captain P. Christeffersen. This vessel will mast and fit out at Port-Glasgow.

Thistlebank.—On December 26th Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a four-masted steel barque, named *Thistlebank*, to the order of Messrs. Andrew Weir & Co., Glasgow; the vessel having been built under the superintendence of Mr. Stewart, Glasgow. The dimensions are:—Length, 283 ft.; breadth, 43 ft.; depth, 24 ft. 3 in.; of 2,300 tons register, to carry 2,800 tons deadweight cargo.

Birtha.—On December 26th Messrs. Russell & Co. launched from their east-end yard, Port-Glasgow, a handsomely-modelled three-masted barque named *Birtha*, of 1,300 tons, to carry 2,330 tons deadweight. Dimensions:—Length, 236 ft.; breadth, 36 ft.; depth, 21 ft. 9 in. This vessel is built to the order of Mr. A. F. Klaviness, Sandefjord, Norway, and is to Lloyd's highest class and Norwegian Veritas. After the launch the vessel was berthed in the east harbour to mast and fit out. It may be added that the keel of this vessel was laid on 1st of October, so that she has been built, under the management of Mr. Peter Taylor, in the remarkably short period of 2 months, 26 days.

Robert Duncan.—On December 27th Messrs. Robert Duncan & Co., Port-Glasgow, launched a four-masted sailing ship of about 2,000 tons register, capable of carrying 3,500 tons deadweight cargo. Length, 270 ft.; breadth, 40 ft.; depth of hold, 24 ft. 6 in. This vessel is for the Robert Duncan Ship Co., Limited, the managing owners being Messrs. Leitch & Muir, Greenock. The vessel was named *Robert Duncan*.

Henry Dumois.—On December 27th the Grangemouth Dockyard Co. launched a steel screw steamer, to the order of Messrs. Winge & Co., of Christiana, of the following dimensions, viz.:—209 ft. long, by 30 ft. beam, by 22 ft. depth of hold to spar deck. She has been built to the highest class at Norske Veritas, spar deck rules, and is intended for fruit trade between Central America and the United States. She was named the *Henry Dumois*. The engines are being fitted up on board by Messrs. William King & Co., Limited, Glasgow. They are of the triple-expansion system.

Lord Ailsa.—On December 30th the Ailsa Shipbuilding Co. launched a handsome steamer for Messrs. J. & A. Wyllie, of Troon, her dimensions being 244 ft. long; 34 ft. beam; and 18 ft. 6 in. moulded depth. She is of the latest well-decked type with poop and bridge combined, in which is accommodation for a limited number of passengers and captain, officers, and engineers, and a topgallant forecastle for crew. She will be classed 100 A1 at Lloyd's, and is supplied with steam winches, steam windlass, and Mnir & Caldwell's steam steering gear. She is to be fitted with a set of triple-expansion engines by Messrs. Dunsmuir & Jackson, of Govan, having cylinders 18 in., 29 in., and 48 in. by 36 in. stroke, with Brown's hydraulic and steam starting gear, Weir's evaporator and steam ash hoist. As the ship glided into the water she was gracefully named *Lord Ailsa* by Lady Aline Kennedy, daughter of the Marquis of Ailsa. A large company accepted invitations to attend the ceremony, and after the launch they were entertained to luncheon.

Scot.—On December 30th, Messrs. William Denny & Brothers launched, from their shipbuilding yard at Dumbarton, the *Scot*, a steel screw-steamer of 7,000 tons, built to the order of the Union Steamship Co., Limited. The vessel, which has been specially designed for the South African Mail Service, will be the largest and most powerful steamer on the route. Her dimensions are:—Length on the water line, 460 ft.; length over all, 500 ft.; breadth, 54 ft. 6 in.; depth, moulded, 37 ft. 6 in. Like most of the first-class vessels which have gone from Clyde yards, the *Scot* is not only well built, but very handsome. She has two pole masts, schooner-rigged, and two large elliptical-shaped funnels. A handsome clipper bow, on which has been placed a figure of Sir William Wallace, adds to the appearance of the hull. The hull itself is entirely of steel, and has been constructed on the cellular-bottom principle. Ten of the fourteen bulkheads into which it is divided extend to the upper deck, minimising the danger in the event of collision. In designing the upper portion special care was taken by the builders to ensure strength. Portions of the hull which are usually separate were worked into the general structure, and the stern frame and brackets for carrying the propellers made exceptionally strong. The accommodation for passengers is of a superior description. Quarters have been provided for 208 first-class passengers, 100 second-class, and 100 third-class, but should emigrants at any time become more numerous a rearrangement of the steerage will permit of several hundreds additional being carried. The first-class passengers will be berthed forward and amidships before the boilers, the second-class aft in the poop, and the third-class on the main-deck abaft the engines. The promenade deck, reserved for first-class passengers, is 257 ft. long. In the grand saloon a large and lofty apartment on the upper deck, beautifully decorated from designs by Mr. J. M. Crawford, nearly 190 persons may dine at one time. The sides of the room are of carved sycamore, and the panelling of the ceiling is richly decorated in a free classic style. Above the grand saloon is the music-room, and below it the children's saloon. The grand staircase, from which all are entered, is of teak and walnut elegantly carved. The music-room and the grand staircase are lighted by large stained-glass domes. The smoking-room is on the promenade deck. The state rooms are a special feature of the new vessel. In each of 33 rooms accommodation has been provided for one passenger, and 27 have berths for two. The remainder have been fitted up as family cabins. The second-class dining saloon is the full width of the ship, panelled in polished hardwoods, and fitted to accommodate 72 persons. Below it is an auxiliary saloon, adjoining which are a number of cabins. The accommodation for third-class passengers is above the average. Six of Messrs. Brown Brothers' electric fans have been provided for the ventilation of the passages and cabins on the main deck. Two Blackman air propellers, which have been fitted over the machinery, will prevent the fumes of steam and oil from annoying passengers on deck by enabling the engineers to keep the skylights closed. The vessel will be lighted throughout by electricity. Of the 16 boats which the ship will carry 10 will be lifeboats, and 4 Berthon's patent collapsible boats. Each will carry a vessel for distributing oil on the sea in heavy weather, in conformity with the Board of Trade requirements. The vessel's speed, with an exceptionally deep draught, will be, it is expected, over 18½ knots. Her engines, which are of the triple-expansion type, have been supplied by Messrs. Denny & Co., and the two sets are expected to develop about 12,000 H.P. The cylinders are 34½ in., 57½ in., and 92 in. diameter, and the stroke of each engine 60 in. The starting-gears have been combined, and work amidships, enabling one engineer to control both engines. To the starting-gear has been fitted an automatic arrangement designed by Mr. A. B. Brown, Edinburgh, which in the event of the engines racing through accident to a propeller shaft or other unexpected cause, will, by throwing the valve motion into mid-gear, at once stop them. Steam will be supplied by six boilers, working at a pressure of 170 lbs. to the square inch. The boilers, which are of the best Siemens-Martin mild steel, have been constructed under the supervision of the Board of Trade and Lloyd's surveyors. There was a large attendance at the launch, immense crowds of people thronging the yard and lining both banks of the Leven. Miss Giles daughter of Mr. A. Giles, M.P. for Southampton, performed the christening ceremony shortly before three o'clock, and the huge vessel entered the water amidst loud cheers. After the launch a large number of ladies and gentlemen were entertained at luncheon in Messrs. Denny's offices.

Massilia.—On January 10th a steel steamer, named the *Massilia*, built to the order of the French Steam Navigation Co., Marseilles, was launched from the Camperdown Shipyard, Dundee, by Messrs. Gonrlay Bros. & Co. Her dimensions are:—Length, 340 ft.; breadth, 41 ft.; depth of hold, 28½ ft. She is upwards of 3,000 tons gross, and will be propelled by triple-expansion engines of 400 H.P.

Ladye Mabel.—On January 12th there was launched from Messrs. Ramage & Ferguson's shipbuilding yard, at Leith, a very large and powerful steel screw steam yacht, over 700 tons Y.M., built to the order of Lord Ashburton, The Grange, Alresford, and designed by Mr. Storey, of London. Having been designed specially for cruising, her lines are those of a seagoing vessel, while the principal parts of the hull have been made much heavier than is required for Lloyd's 100 A1 class. The principal dimensions are:—Length, 204 ft.; breadth, 27 ft.; and depth, moulded, 18 ft.; the engines being triple-expansion, with cylinders 18½, 27½, and 47 in. diameter, by 33 in. stroke, supplied with steam at 160 lbs. pressure from an unusually large steel single-ended boiler, having four corrugated furnaces. Her rig is that of a three-masted schooner, with pole masts, the sails being supplied by Lapthorn & Ratsey, Gosport. On deck a spacious deckhouse contains deck-saloon, chartroom, etc., while the principal accommodation is below forward, and consists of drawing-room, dining, large owner's cabin with dressing-room attached, and a number of state-rooms, all fitted up in a most complete and sumptuous manner. Several state-rooms are situated abaft the engines, and the rest of the vessel is set apart for officers', engineers', and crew's quarters. All the latest appliances and inventions suitable for a steam yacht have been adopted, including steam windlass, steam steering gear, steam capstan, Jarman's after steering gear, and electric lighting throughout. On leaving the ways the yacht was named the *Ladye Mabel* by Miss Herdman, of Hazel Bank, Corstorphice, and afterwards towed to the Albert Dock to receive her machinery. Besides the *Ladye Mabel*, Messrs. Ramage & Ferguson have under contract a 900-ton auxiliary steam yacht for Russia and a 453-ton steam yacht for a Glasgow gentleman, as well as several large merchant vessels.

Gurly.—On January 13th there was launched from the yard of Messrs. Munloch & Murray, at Port-Glasgow, a finely modelled steel twin-screw steamer of the following dimensions:—Length, 195 ft.; breadth, 28 ft.; depth, moulded, 20 ft. 2 in. The vessel has been built to the highest class in Burean Veritas, and is intended for passenger and fruit trade between New York and South America, and will attain a high rate of speed. Her holds are specially adapted for the safe carriage of fruit in equal temperature. On leaving the ways she was named the *Gurly* by the wife of Captain Lund. The vessel is a sister ship to the s.s. *Holguin*, launched by the same builders last month, both of them being built to the order of Mr. Jacob Christensen, Bergen, under the direct superintendence of Captain K. Reimers. The engines are being supplied by Messrs. Muir & Honston, Glasgow, and are of the triple-expansion type: cylinders, 14 in., 23 in., and 36 in., by 24 in. stroke.

LAUNCH.—IRISH.

Manchester.—On January 3rd Messrs. M'Ilwane and M'Coll, Limited, launched at Belfast the new steamer *Manchester*, built for Messrs. Samuel Lawther & Co., Belfast, and intended for the new service between Belfast and Manchester. The dimensions of the new steamer are:—Length, 180 ft.; breadth, 27 ft. 6 in.; depth, 13 ft. 11 in. She is the first steamer of the new company which has been formed, and of which Mr. Samuel Lawther, J.P., is the head. After her maiden trip the steamer will ply between Belfast and the Mersey, but when the ship canal between Liverpool and Manchester has been completed the vessel will then, after calling at Liverpool, be enabled to proceed up to Manchester.

LAUNCH—German

Lowenburg.—On December 9th the Flensburg Shipbuilding Co. launched a new steamer for the Steamshipping Co. Hansa, in Bremen. She is 270 ft. 9 in. by 37 ft. 2 in. by 24 ft. 6½ in., and classed 100 A1 at British Lloyd's and German Lloyd's. The vessel was christened *Lowenburg* by Miss Scheildt.

LAUNCH—Swedish.

Ledobold.—This powerful ice-breaker has been launched from the Lindholmen Shipbuilding Yard, Gothenburg, for the Russian Government. She is intended to keep open the port of Nicolaieff, in the Black Sea. The vessel, which is built entirely of Swedish steel, attained a speed of 11½ knots per hour, which is 1½ knots beyond the contract speed. She is constructed to break ice 18 in. in thickness with ease.

TRIAL TRIPS.

Schonburg.—On December 2nd a new steel screw steamer, built by the Flensburg Shipbuilding Co. for the Steamshipping Co. Hansa, in Bremen, went on her trial. The vessel is of the following dimensions:—Length, 270 ft. 9 in.; breadth, 37 ft. 2 in.; depth, 24 ft. 6½ in. Her engines, on the triple-expansion principle, have 1,200 I.H.P., and built by the Flensburg Shipbuilding Co. She is classed 100 A1 at Lloyd's and German Lloyd's. Speed, 12 knots.

Macduff.—On December 20th this fine steel screw steamer, built by Messrs. W. Gray & Co., Limited, to the order of Messrs. J. Warrack & Co., of Leith, had her trial trip in the bay, off Hartlepool. She is a three-decked vessel, having a steel main deck and iron upper deck, sheathed with wood, and she takes Lloyd's highest class. Her dimensions are: Length, over all, 330 ft.; breadth, 40 ft. 6 in.; depth, 27 ft. Fine triple-expansion engines have been supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, the cylinders being 25 in., 40 in., and 65 in. in diameter, and the stroke of the piston 42 in. The boilers, two in number and built of steel, are of large size, and work at a pressure of 160 lbs. per square inch. The ship and machinery have been built under the superintendence of Capt. M. J. Butcher and Mr. M. A. Hall respectively, both these gentlemen being on board during the trial. Mr. Warrack, jun., one of the owners, was also on board; and Mr. Thos. Mudd represented the engine builders. After some manœuvring of the vessel to the instructions of Mr. Berry, the compass adjuster, the engines were run with a view to test their performance, the result being highly satisfactory. The freedom and smoothness of the working parts, the absence of all knock or other unpleasant sound, and the rigidity of the framework being all that could be desired. After the trial the vessel proceeded to Middlesbrough, where she will take in part cargo, making up the full complement at Glasgow and Liverpool, from which latter port she proceeds, under the command of Capt. W. H. Hood, for Chinese ports, having been designed for that trade. The vessel was manipulated on her trial trip by her Chinese crew.

Wirral.—On December 22nd the trial trip took place of the new Woodside steamer *Wirral*, the sister ship of the *Mersey*, both of which have been built by Messrs. J. Jones & Sons, of the St. George's Ironworks, Liverpool. The *Wirral* left the Woodside landing-stage about one o'clock, there being on board several members of the Town Council, Captain Pinhey, the ferry manager, and others. There was a heavy fog during a considerable portion of the trial, but it lifted sufficiently to show that the steamer was equal to more than fourteen knots an hour, which is about two knots above the speed guaranteed by the builders, and half a knot more than that of the *Mersey*. During the trip, lunch was served on board, and Mr. Charles Jones, on behalf of the builders, expressed the belief that this steamer, like its predecessor, would fully come up to the anticipations of the Corporation, both in regard to speed and consumption of coal. Mr. Thomas Shaw, in the course of some remarks, said there was considerably less vibration in the *Wirral* than in the *Mersey*, and she also seemed to have more speed. It was believed that these two boats would run the ferry with a ten-minutes service, which would result in a considerable saving to the Corporation.

Renwick.—On December 22nd the new steamer *Renwick*, which has been built by the Tyne Iron Shipbuilding Co., Limited, Willington Quay, to the order of Messrs. Fisher, Renwick & Co., of Newcastle, left the Tyne on a trial trip, The vessel is a handsome steamer of the following dimensions, viz.: Length, 180 ft.; breadth, 28 ft.; draught, 13½ ft. The machinery, which has been built by the North-Eastern Marine Engineering Co., Limited, Wallsend, consists of a set of tri-compound engines, having cylinders 13½ in., 22½ in., and 36 in. by 29 in. stroke, and during the trial the engines worked without a hitch of any kind.

Helen Craig.—On December 24th the screw steamer *Helen Craig*, built by Messrs. Workman, Clark & Co., of Belfast, went on her trial trip in Belfast Lough. This vessel has been built for Messrs. Hugh Craig & Co.'s coal trade. The average speed attained on several runs over the measured mile was 11½ knots.

Latona.—The *Latona*, the first for trial of a large fleet of quick second-class protected cruisers laid down under the Naval Defence Act, arrived at Portsmouth on Wednesday, December 24th, from Barrow-in-Furness, where she was built and engined by the Naval Construction and Armaments Co. She left the northern port on Monday morning, after having been inspected under way by Admiral Hopkins, Controller of the Navy, Admiral Morant, supervisor of contract work, and Mr. W. H. White, director of Naval Construction. The working of the machinery was watched by Mr. Mayston, on behalf of the Admiralty, and by Mr. Wishart in the interests of the dockyard authorities at Portsmouth. When off Holyhead the *Latona* encountered a terrific storm, and although the engines were slowed down, great quantities of water were shipped, and nearly the whole of the navigating staff were more or less prostrated by sea-sickness. The vessel behaved very well, the whole distance being accomplished at an average speed of 15 knots, with a mean power equal to 4,500 horses. The *Latona* is designed for a speed of 18½ knots with 7,000 horses and 20 knots under forced draught with 9,000 horses, which she will probably realize, as her boilers, which are double-ended with return tubes, have been increased in size beyond the original specifications. In leaving Peel Bay the cruiser touched the mud.

Celtic King.—On December 27th the s.s. *Celtic King*, built by Messrs. Workman, Clark & Co., Limited, Belfast, for Messrs. William Ross & Co., of London, left the Queen's Dock and proceeded on a trial trip down the Clyde. This vessel is in every way a fine specimen of a first-class cargo steamer—her length is 371·8 ft.; breadth, 44·2 ft.; depth of hold, 27·2 ft.; gross tonnage, 3757·65; and net, 2428·78. She is fitted throughout vessel and engine-room with electric lighting by Messrs. Holmes, of Newcastle. The saloon is placed aft, to suit the requirements of the special trade intended, and is handsomely finished and comfortably furnished for a small number of passengers, along with the captain and officers. The vessel being about to be engaged in the Australian trade special attention has been given to the insulation of hold, which has been carried out by Messrs. Bell & Birnie, of Liverpool. Two sets of powerful compound refrigerating engines have been supplied and fitted by Messrs. J. & E. Hall & Co., Limited, of Dartford, each set being equal to the refrigeration of a space of 180,000 cubic feet. The main engines are by John & James Thomson, Finnieston Engine Works—triple-expansion, working at 160 lbs. pressure. The cylinders are 26½ in. by 44 in. by 72 in., and the stroke 4 ft. All three cylinders are fitted with Morton's patent valve gear, and Thom's patent slide valve is applied to the low pressure. The engines are one of three sets made by the Messrs. Thomson, the first of which was fitted on board the City Line steamer *City of Perth*, presently away on her second Indian voyage, whilst the last set awaits the *City of Agra*, of the same line. Steam is supplied in the *Celtic King* by two double-ended boilers, 13·3 diam. by 17·3 long, having 12 ribbed furnaces by Messrs. Brown & Co., of Sheffield. At the trial on Saturday the engines worked with great smoothness, and developed 2,200 H.P. A mean speed of nearly 13 knots was obtained at measured mile, the vessel being in comparatively light draught (15 ft. 3 in. mean), having ballast tanks (which extend in double bottom throughout the entire length of vessel) filled, and 1,000 tons coal in hold. For dealing with cargo six 7-in. steam winches, by Messrs. Clarke, Chapman & Co., of Gateshead, have been provided, and for pumping water-ballast a special engine of Messrs. Thomson's own make, capable of discharging 150 tons per hour. These are supplied with steam by a large donkey boiler, 9 ft. diameter by 8 ft.

long, with two 30 in. furnaces. On returning to the harbour the *Celtic King* was placed in a loading berth in Queen's Dock, the work of loading being in the hands of Messrs. Aitken, Lilburn & Co., Glasgow.

Arensburg.—On December 30th the new steamer *Arensburg*, built at the Elsinore Iron Shipbuilding and Engineering Co., for account of the Deutsche Dampschiffsfahrt Gesellschaft Hansa, in Hamburg, had a very satisfactory trial trip in the Sound. She is built entirely of steel to highest class, special survey, of British and German Lloyd's. The principal dimensions are:—Length, 270 ft.; breadth, 37 ft.: and depth in hold, 16 ft. The *Arensburg* has water ballast in double bottoms the whole length (bracket system). The engines, which have worked thoroughly satisfactorily during all the trials, are triple-expansion With 1,200 I.H.P. the consumption of coal was 2 lbs. per H.P. per hour; the greatest power indicated was 1,650 H.P. The *Arensburg* is intended to trade upon the Plate River.

Amara.—On January 3rd this vessel was taken on her trial trip from Sunderland to Middlesbrough. She has been built by Messrs. J. Blumer & Co., of Sunderland, and is of the following dimensions:—Length, 290 ft.; breadth, 40 ft.; and depth of hold, 25 ft. 5 in., built under the spar-deck rule to the highest class at Lloyd's. The engines are by the North-Eastern Marine Engineering Co., of Sunderland, of the triple-expansion type, with cylinders 23½ in., 38 in., and 62 in. by 42 in. length of stroke. Steam is supplied by two double-ended boilers 11 ft. 9 in. diameter, and 15 ft. 6 in. long, with a working pressure of 160 lbs. Both hull and machinery have been constructed under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and the vessel is a sister ship to the s.s. *Tigris*, previously built by the same firm, and she will be added to the fleet of the Persian Gulf Steamship Co., and is specially constructed for use in their Pilgrim trade, with all the latest improvements, including steam windlass and steering gear, and specially ventilated accommodation amidships. All the upper decks and houses are of teak. Owing to the prevalence of heavy fog it was impossible to take a formal trial trip, but a run was taken by the patent log during a lift in the fog, which gave as a result 12 knots exactly per hour. The machinery workedvery smoothly throughout.

Barracouta.—On January 9th the new third-class cruiser *Barracouta*, whose previous trials have proved unsuccessful, left Sheerness for another trial under natural draught, to determine the acceptance of her engines and boilers from the contractors. The trial was of eight hours duration, and proved very successful, both engines and boilers working well.

Mohawk.—On January 14th the new third-class cruiser *Mohawk*, 1,770 tons, 3,500 H.P., left the Nore for another trial of her engines and boilers. The previous trial of the *Mohawk* proved unsatisfactory through the heating of the port eccentric rod, and in order not to delay her completion for sea, she has been fitted with an eccentric rod removed from her sister cruiser *Tartar*. The present trial was made under natural draught, and proved of a successful character, both engines and boilers working well.

Asp.—On January 14th the *Asp*, a new water-tank and tug vessel, recently built for service at Sheerness Dockyard by Messrs. R. & H. Green, at a cost of £8,600, underwent a six hours' official trial of her machinery at the mouth of the Thames with satisfactory results. She is to be prepared for immediate service.

Wallaroo.—On January 15th the colonial cruiser *Wallaroo*, the last of the three of this type which has been recently built at Elswick as part of the new colonial fleet, made her final eight hours' power trial off the Tyne. Her propelling machinery consists of two sets of inverted triple-expansion engines of a collective H.P. of 4,500 with natural draught, and 7,000 with forced draught. Each set has a high-pressure cylinder 31 in., intermediate 46 in., and low pressure 70 in. in diameter, with a stroke of 33 in. Steam is supplied at a pressure of 155 lbs. to the square inch by four double-ended return tube boilers, each having four furnaces. During the trial the sea was perfectly smooth, with a stiff breeze from the north-west. Throughout the whole eight hours both engines and boilers worked in a most satisfactory manner, the boilers giving a free supply of steam, and the engines showing no signs of heating whatever. The main results of the entire run were as follows:—Steam in boilers, 145 lbs.; vacuum starboard, 28·2; port, 28·4 in.; revolutions, starboard, 149; port, 146·8; total I.H.P. starboard, 2,278; port, 2,285; collective I.H.P. 4,563, or a margin of 63 H.P. over the contract requirements. The mean air pressure in the stokehold was 0·57 in. The whole trial passed off without a hitch, and a noticeable feature of it was the fact that the engines had never previously been run at anything approaching the trial speed, the only previous trial having been one made at moorings. The foregoing results were considered so satisfactory by the Admiralty officials that the vessels will be taken over without further trials.

Lismore Castle.—On January 15th the new Castle Line intermediate steamship *Lismore Castle*, which has been built for Messrs. Donald Currie & Co., by Messrs. Barclay, Curle & Co., Limited, went on her trial trip down the Clyde. She ran twice between the Cloch and Cumbrae lights, and maintained a mean speed of 14½ knots per hour. The guests present were numerous and representative of the shipping interests of the Clyde. The trial was in every way satisfactory, and the vessel proceeded afterwards to Barrow on her way to London to take up her station on the Castle Line to South Africa. The dimensions of the *Lismore Castle* are 396 ft. by 43 ft. by 31 ft., with a tonnage of 4,045 tons, and a deadweight carrying capacity of fully 5,000 tons. She has accommodation for 30 first-class, 40 second, and 80 third-class passengers, and when necessary 400 passengers on the main deck. The *Lismore Castle* will leave London for South Africa, *viâ* Flushing and Madeira, on the 17th of February.

Gossamer.—On January 16th the official natural draught trial of the new first-class steel gunboat *Gossamer*, which took place in the North Sea, proved a complete success in every respect. The *Gossamer* was the first ship which had been engined as well as built by the dockyard authorities at Sheerness. At the trial the boilers gave a plentiful supply of steam with a total absence of priming, while the engines worked smoothly without any of the bearings becoming heated. The engines were designed to develop 2,500 H.P., but the mean for the eight hours' run was 2,618, which was considered very satisfactory. The mean pressure of steam in the boilers was 133·3 lbs, and the mean revolutions per minute 228·6 A thorough examination was made of the boilers on the return of the *Gossamer* into harbour. It was found that they were perfectly tight and that there was not a single leaky tube. There was no undue vibration of the ship when steaming at the highest rate of speed, and no difficulty was experienced in keeping her steady on her course. Commander J. W. Osborne, of the Medway Steam Reserve, was in charge of the ship The *Gossamer* is not yet completed for commission, but the dockyard authorities claim that she has been more economically built than her sister ships which have been built in Government yards and engined by private firms She is coated with Hartmann Rahtjen's composition.

Glenisle—On Saturday, January 17th the s.s. *Glenisle*, built by Messrs. Edward Withy & Co., Hartlepool, for Messrs. Livingston, Conner & Co., West Hartlepool, was taken to sea for her trial trip. The vessel is built of steel and to the highest class at Lloyd's, and has a very large deadweight carrying capacity. She is fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool, with cylinders 20 in., 31½ in., and 53 in. by 36 in. stroke, and they embrace all the latest improvements for economy of fuel and efficiency in working. During the trial trip a mean speed of 11 knots was obtained, and the engines worked with great smoothness. Among the party on board who attended the trial trip were Captain Conner, representing the owners; Mr. Swadwell, the owner's superintendent engineer; and Mr. Robinson, representing the engine-builders.

Achilles.—On January 21st the *Achilles*, battle-ship, was taken outside Plymouth Breakwater for a six hours' trial of her engines. Her gun trials were carried out simultaneously. The vessel's ten boilers have been renewed, but are replaced with others of an equally obsolete type, six of which can only withstand a pressure of 25 lbs., whilst the remaining four can be worked to 30 lbs This is due to the fact that the ship is supplied with simple engines of an old pattern originally built in 1864 by Messrs Penn. Four of the boilers are 18 years old, and the pressure has consequently been reduced to a minimum. The most important alteration in the vessel's armament has been the addition of two 6-in. breech-loader guns on the upper deck, whilst eight 3-pounder quick-firing and 16 machine guns have also been supplied. The main battery still consists of 19 9-ton muzzle-loader guns. The gun trials, held with the object of testing the mountings, were entirely satisfactory, but the steam trial was less successful, as, after only 3½ hours, the *Achilles* was obliged to return to the Sound, owing to the slacking back of the after gudgeon. The mean I.H.P. was 4,750. In view of the trifling nature of the defect, the officials have asked permission to be allowed to accept the vessel without further experiments. It is understood that Captain Holland will obtain the command of the vessel when commissioned for service with the Channel Squadron.

Yung Ping.—On January 23rd the s.s. *Yung Ping*, built by Messrs. Craig, Taylor & Co., of Stockton-on-Tees, to the order of Messrs. Russell & Co., of Shanghai, New York and London, and under the superintendence of Messrs. A. & W. Dudgeon, of 112, Fenchurch Street, London, was taken out to sea for her trial trip, which proved very satisfactory. The dimensions of the vessel are:—223 ft. by 32 ft. by 13 ft. 11½ in. She is to trade in Chinese waters, and is fitted with teak decks, and luxurious passenger accommodation. She has water ballast, and is classed 100 A1 at Lloyd's. The engines by Messrs. William Allan & Co., Scotia Engine Works, Sunderland, are 15 in., 25 in., 41 in., by 24 in. stroke, and on the measured mile, after a number of runs, a mean speed of 9·8 (nearly 10 knots) was easily obtained, the weather at the time being fairly rough. The representatives of the owners were thoroughly satisfied with the trial. The vessel, which was loaded, proceeded at once to China, under the command of Captain Jordan.

Ashley.—On January 23rd the s.s. *Ashley*, built by Messrs. Craig, Taylor & Co., and purchased by Mr. Wm. R. Rea, of Belfast, for the North of Ireland Steamship Co., Limited, was taken to sea for her trial trip, which proved highly satisfactory, a speed of over 12 knots being obtained. The vessel is of the following dimensions:—300 ft., 37 ft. 9 in., by 21 ft. 9 in.; built on the web frame and cellular bottom principle, with long bridge and raised quarter-deck, short well, and topgallant forecastle. She has steam windlass by Emerson, Walker & Thompson Bros.; outfit of winches by R. Roger & Co.; steam steering gear by Alley & MacLellan, and all modern improvements so as to admit of rapid loading and discharging. Her engines, on the triple-expansion surface-condensing principle, are by Messrs. Westgarth, English & Co., of Middlesbro', with cylinders 21 in., 34 in., and 56 in. by 39 in. stroke; two boilers 160 lbs. pressure, which worked very smoothly during the whole of trip. The vessel will be taken out by Captain Makood, who took the *Shaftesbury* out some time ago, which latter vessel was also built by Messrs. Craig, Taylor & Co. for the same owners. The trial trip was under the inspection of Mr. Joseph Lewis, consulting engineer, Belfast.

Llanthony Abbey.—This steamer, built by Messrs. Ropner Son, Stockton, for Messrs. Pyman, Watson & Co., Cardiff, has lately had her trial trip. The vessel is 290 ft. long; 29 ft. broad; and 20 ft. 9 in. deep. She has been engined by Messrs. Blair & Co., Stockton, on the triple-expansion principle, the cylinders being 22 in., 36 in., and 59 in. in diameter, by 39 in. stroke, and working at 160 lbs. pressure. The trip was most successful, everything working satisfactorily.

Reviews.

Electric Light Installations and the Management of Accumulators. By Sir D. Salomons, Bart. London: Whittaker & Co. 1891.

This work has reached its sixth edition, and the author, in his opening remarks, states that no expense has been spared in experiments to ensure reliable results being furnished to the reader. Mention is made of the fact that manufacturers have no time nor inclination for collating facts which may damage the reputation of their wares. This volume is then put forward as a medium between seller and buyer, and the number of editions reached proves very fairly that the end in view has not been altogether unsuccessful. There are two general divisions, the first and smaller part being devoted to cells and their management. The Electric Power Storage and the Elswell-Parker kinds come in for most attention. The directions may be taken to be very minute, and it would be possible for an unprofessional person to achieve some measure of success if he followed all he found here. We are told that every cell with bar plates gives two volts, and that an installation requiring 50 volts would be well started with 27 cells. The two ways of doing this are then explained. The chemical results of charging the cells is given in formulæ at different stages of the process. The significant remark is made in this connection that there is far greater loss with storage than is generally supposed, amounting to 30 or 35 per cent. Valuable figures are found in tables relating to the efficiency of the various secondary batteries, and obtained from a paper read before the Society of Telegraph Engineers in 1887. Reference is then made to the fact that though there is a loss, the use of an accumulator is a necessity in private installations, there being no need to run the engine and dynamo during the many hours when only a few lamps are required. A feeling of security is also given against breakdowns, and there is the advantage that during the cleaning of the machinery or slight repairs there is a sufficient reserve to ensure light over the time that darkness would otherwise ensue. The opinion is expressed that eventually the accumulator will be available for public supply as well as private lighting. In the chapter on "Discharging," to give a general idea of the storage capacity of cells in practice, we find it stated that a 15-plate E.P.S. or E.P. cell gives 330 ampère-hours available, and since the maximum discharge is 30 ampères it is evident that such a discharge can last for 10 hours. An ampère-hour meaning one ampère flowing for one hour. The chapter on "Failures" is very complete, and to attempt to quote any particular example would be a very difficult matter. The author sums up the question by saying that from the instances quoted it may be thought that an accumulator is a constant source of annoyance; this only applies, however, when no watch is kept, and we suppose the same may be said of any other department of engineering.

In the second part, on Installations, we are first introduced to motors, and gas-engines are brought under notice, also petroleum motors. Then follow sundry details of boilers and engines before dynamos are touched upon. In the electrical department the author is evidently more "at home." The points claimed for dynamos are: (1) The brushes must have a proper inclination. (2) The pressure should be adjusted properly. (3) The lead must be given correctly for the current. (4) Occasional application of oil or grease to the commutator should be resorted to. (5) Scrupulous cleanliness in regard to brushes and commutator must be observed. These are gone into in detail. No work on installations would be complete without a chapter on switchboards, and the principal forms are found here, as also fuses, ammeters, voltmeters, &c. Sir Wm. Thomson's marine voltmeter is described and illustrated, though the reasons for the title are not made clear at all. The chapter on "Action of Cells with Dynamo" is a very good one and contains many useful hints towards carrying out an installation. It finishes with the formulæ—

$$C = \frac{E}{R}$$
$$W = C^2 R$$

C being the current in ampères
E = E. M. F. in volts
R = Resistance in ohms
W = C E = watt or power
and 1 Board of Trade Unit = 1,000 watt hours
746 watts = 1 H.P.
∴ 1 B.T.U. = 1⅓ H.P.

Governing Methods of Working and Alternating Currents are two chapters of considerable importance and well dealt with. There is also another on Estimating. Sufficient has been said, however, to show that the volume is of a valuable character. It will be gathered that the subject is well gone into and treated in a somewhat popular way. This does not, however, detract in any way from its general merits, and it may be well recommended to those who, wishing to gain knowledge, do not desire to meet on every leaf with mathematics of a more or less abstruse character, and probably only thoroughly comprehensible to the authors themselves.

Handbook to Beall's Compass Deviascope. By George Beall, F.R.G.S. London: Henry Hughes & Son.

This handbook, now in its second edition, is intended to assist the student in the use of Captain Beall's deviascope, and in acquiring through it a knowledge of the different actions of permanent magnets, and the actual effects on the needle, of the magnetic forces due to the various arrangements and qualities of iron generally met with on board ship, as well as showing the usual co-efficients and method of compensating them. It is also intended to confirm his theoretical knowledge and enable him to acquire a more intelligent conception of, and a better practical insight into, the action of the various magnetic forces and the subject of compass deviation. It deals pretty exhaustively with the subject, and among other items, shows how to construct curve of deviations: how to determine the deviation of compass by "Pelorus" at sea, or by reciprocal readings; how to compensate magnetic disturbing forces by what is known as the "tentative" process. It also treats of sub-permanent magnetism of ships and how to compensate it; quadrantal deviation and heeling error, and their compensation, &c., &c. The handbook contains many useful hints and tables, and is furnished with a coloured plate in red and blue, showing the sub-permanent polarities of ships when built with their heads to the north, south, east or west; as well as Napier's Diagram of Deviations. It is neatly got up, and ought to be of great service to those for whom it is designed.

Correspondence.

It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

SHIPBUILDING.

To the Editor of THE MARINE ENGINEER.

SIR,—In your comments on shipbuilding at the Hartlepools, in your January number, you say Messrs. W. Gray & Co. launched, in 1890, 27 vessels off their nine berths, having a gross register of 64,253 tons—this gives an average of three steamers, and 7,139 tons, off each berth; and you go on to say "this is a performance in the way of rapid production, which, we venture to say, has *never been equalled* by any other shipbuilding firm, and which, if it should be equalled in the future, is scarcely likely to be surpassed."

Now we have only four building berths, and last year we launched 12 steamers, having a gross register of 32,662 tons, which gives an average of three steamers and 8,165 tons off each berth.

From this, it is clear, we have not only *equalled* but *surpassed* the performance you speak of.

Yours respectfully,
ROPNER & SON.

Stockton-on-Tees, *January 9th*, 1891.

THE NAVY.

To the Editor of THE MARINE ENGINEER.

SIR,—I shall be very much obliged if you will publish the accompanying letter to the Prime Minister.

I am, Sir, your humble servant,
ADMIRAL OF THE FLEET,
THOMAS SYMONDS.

Torquay, *January 20th*, 1891.

TO THE MOST HONOURABLE THE MARQUIS OF SALISBURY, PRIME MINISTER, K.G., &c., &c.

MY LORD,—I beg most respectfully to submit for your consideration the truly perilous condition of our country during war, owing to the exceedingly weak state of the Navy, as compared with that from 1793 to 1815, and beseech you to read what follows.

We have so few cruisers that, even in 1895 it will be impossible to supply our coaling stations satisfactorily with coal during war with France alone.

Without such supply both our fighting and mercantile navies would be paralyzed.

We export yearly 33 millions of tons of coal.

The tonnage of our Mercantile Marine is—steam, 5,156,815 tons; sailing, 3,361,252. Total, 8,518,067 tons.

To supply the punctual supply of our food (valued at £140,000,000, more than one-third our total imports, its real value being incalculable) would also be impossible, because it *depends upon coal supply*, and to make safe our commerce, &c., only intensifies the difficulty.

Judging by the naval strength that was necessary in 1814, when we had 758 vessels to 501 (including torpedo boats) in 1895!

In 1814 our Navy had neither of the *gigantic* duties to perform, viz.: supplying coal all over the world, and food to our population—while our commerce, &c., were small fractions of what they are now. All this proves the *impossibilities* that I have named above.

In attempting to make these facts known, I am met by the cry—the taxpayers have just given 10 millions. They will give no more. This from Ministers of State, Members of Parliament, &c.

In vain do I seek for a proof of this. On the contrary. When the public movement, which caused the Naval Defence Bill, occurred, Ministers had before them the very able report of three of our best Admirals, wherein they showed how ill defended our trade was, and how numerous were our shortcomings.—See Report of Naval Manœuvres, 1888.—Since then 70 vessels are being constructed and when finished—see Parliamentary Return, No. 90, March 28th, 1889, p. 18—showing that we shall have only 88 cruisers! Which are quite unequal to the duties I have named above. *But* I can only make out 63 modern, swift cruisers, of which 53 are too small for distant work. They are so deficient in coal capacity, speed in a seaway, &c. The attendance on our 76 battle-ships and other warlike duties, all over the world, would absorb them. The food, commerce, &c., being left at the mercy of our foes, and leaving the convoy of colliers, traders, &c., out of the question.

The fact is—Ministers shy at the question of the Navy. Not understanding it, and from the fear of being thought extravagant.

I sought information from the official Estimates, which any one can examine—and I found that in 1860-61, there were voted, for the *Effective* Service of the Navy, £10,971,102. So-called economists were busy in reducing this moderate sum, until 1885, so low even as £7,308,290. The result was that up to 1885—twenty-five years—fifty-three millions of Naval expenditure was reduced, and the Navy starved into thorough inefficiency. The Navy Estimates are now brought back to about what they were in 1860. *But* they include the Naval Defence Vote!

In 1860 an ironclad cost about £400,000, and one million now!

But strange to say the Army Estimates have risen from £16,286,833 in 1860 to £20,962,357 now. But to make the comparison correct between 1860 and 1890, £1,405,100, the vote for naval armament, now charged to the Navy Estimates, and to the Army in 1860. This must be added. We have consequently for 1860, £16,286,833 against £22,367,457 for 1890-91. An increase of over six millions! Besides this, the Army in India costs about 20 millions. I have heard of no complaint by taxpayers. In fact the taxpayer cry is incorrect. Nonsense.

Which is most necessary to feed our people and safeguard the British commerce, Navy or Army? The Navy most assuredly. If we had five millions of soldiers they could not do so. If our electors were told the *truth* about the Navy, I am sure that the whole sum necessary would be voted by acclamation.

The 22 millions for the Army and 14 millions to the Navy, should be reversed to Navy 22 millions, Army 14 millions. Naval competition would soon cease in France, if she saw that we were really in earnest. It is therefore utterly misleading to say that the taxpayers will not pay to save the country from ruin, and themselves from starvation, when the Army Estimates have been increased six millions since 1884, so very easily! The Naval Defence Bill—10 millions—is only 20 months of the Army yearly increase.

We should not lose a day in increasing our Navy by an ample number of large, fast cruisers, with very large coal capacity; proper colliers, torpedo vessels, &c.; improving our dockyards, docks, &c.

No Admiral or General, worthy the name, or in his right senses, would undertake the responsibility of even the probability of war occurring, without preparing proper Reserves. I may say, with all fairness, that we have little or no Reserve, though I have made myself tiresome in entreating for it.

In the admirable report of three very experienced Admirals —on Naval Manœuvres, 1888, they lay great stress on possessing a proper Reserve force.

In *Personal* our numbers are about 20,000 partly-trained men

The French have 104,000 Inscrits, and 26,000 marine artillery-men and light infantry. Total, 130,000 well-trained men.

We should have, at least, marine artillery men enough, beyond what we have, to garrison our dockyard towns, which should be like the French, under preferts, Admirals.

As to vessels we have none—we need 20 battle-ships and 50 cruisers of all classes *ready for sea* as a *Reserve*—except being manned—to relieve accidents, and even for coaling; passing the crews of those vessels returning to port to those ready for sea.

We have had lately a lesson we should remember.

The Channel Squadron have been detained for weeks, with nothing *to replace them immediately*, which would mean during war, destruction to every thing in the Channel, while under repair, and of one, *even now*, the *Howe*, the Press reports "dangerous to cross the Bay of Biscay"! I believe that not one of those I am about to name were fit for battle until repaired, viz.: *Anson*, very important defects; *Howe*, *Rodney*, *Camperdown*, *Aurora*, *Immortalite*, with no such modern vessels to replace them, even if *one* was sunk in battle. *Camperdown* has had to change one defective gun and repair delicate gun machinery—*Howe* two defective guns—while *Sanspareil*, after waiting two years for her guns, is again delayed. *Inflexible*, boiler damaged, now under repair. Thus eight first-class modern vessels have become unfit for battle in six months, after trifling *peace* service. This would be truly awful during war, and proves the very great necessity there is for an ample *reserve in all ways*. It has taken months to replace the poor little *Serpent*.

My Lord, I should not do my duty if I did not endeavour to impress on you the absolute necessity there is for an enquiry by court martial of 13 Admirals and Captains on the state of the Navy, on oath—as well as their witnesses, to elicit the truth. The whole truth and nothing but the truth.

I beg to apologise to your Lordship for troubling you with so long a letter. But I deem it my bounden and imperative duty to endeavour to make manifest to you how recklessly we are pursuing the road to ruin, in the event of war. For I am certain that 76 armour-clads and 88 cruisers, some of which are of most questionable character—plus small craft—cannot *possibly* fulfil the duties expected of our Navy, and which are so incomparably greater than they were during our last war.

I have the honor to be, my Lord,
Your Lordship's most humble servant,
ADMIRAL OF THE FLEET,
THOMAS SYMONDS.

Torquay, *January 20th*, 1891.

Miscellaneous.

General Exhibition of the Kingdom of Bohemia.—This Exhibition, which is to be held at Prague from May to 15th October next, is meant to celebrate the centennial jubilee of the first Trades Exhibition on the continent at Prague in 1791. It will be held under the protectorate of the Emperor Francis Joseph I., and will, under group xxvii, embrace international sections for engines for the prevention of accidents, for inventions, and for patents. This section is divided into eight different groups, viz.:—Mechanical industries, chemical industries, mining and foundry work, architecture, transport, lighting, ventilation and fire engines, special branches of industry, and literature. Foreigners are invited to take part in this group with equal rights and privileges as the inhabitants of Bohemia. Mr. Arthur Gobiek, Praha-Karlin, Prague, (Carolinenthal), who is a member of the committee, and official representative of the exhibitors forming the group just mentioned, offers his services to any intending English exhibitors, and will be pleased to reply to any enquiries that may be addressed to him.

Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, have received an order from the Union Steam Ship Company of New Zealand to build for them a steel screw steamer for their passenger and fruit trade between Fiji and New Zealand. This firm has also received an order for a steel screw yacht from Peter Coats, Esq. (of Messrs. P. & R. Coats, Limited), Paisley, to build to the design of Mr. G. L. Watson, naval architect, Glasgow. Both vessels are to be fitted by the builders with their patent quadruple expansion engines.

Adams' Southampton Almanac.—We have received a copy of this widely-known and highly appreciated Annual, now in its thirty-seventh year. It is replete with all sorts of general and useful information usually found in similar publications, besides giving minute information, as to the shipping interests of Southampton, Swansea, and Cardiff, of which places excellently drawn and coloured maps are given. It contains lists of the local magistrates, municipal corporations, dispensaries, charity organizations, clubs of all descriptions, dock and harbour officials, dues and charges, nautical and tide tables, police and fire brigade information, &c., &c., and a well-written, interesting, and lengthy retrospect of the year 1890. It also contains a useful cash-ruled diary for the current year, as well as numerous short tales and stories, most of which have been specially written for its pages. The calendar for 1891 seems to be very complete and is accompanied with *notes* of a useful nature in a compact form. Altogether we must congratulate Mr. Adams on the general excellence of his work, and are not at all surprised to learn that it is looked upon as a reliable authority both at home and abroad.

Forging Steel by Hydraulic Power.—Hydraulic forging presses are now in operation all over Europe, and are effecting a complete revolution in the working of large masses of steel. What used to be considered wonderful results in the forging of iron by means of the Nasmyth hammer are now quite put in the shade by the hydraulic forging presses of immense power produced at the Goodman Street Engineering Works in Leeds, whence was provided not very long ago the first large forging press that ever was made, and which is now in full work at the armour-plate manufactory in Sheffield of Messrs. John Brown & Co., Limited It is of 4,000 tons, and is worked by 2,000 H.P. pumping engines, and commanded by power-travelling cranes capable of lifting 150 tons. At the works of Mr. Krupp, and at those of Messrs. Schneider & Co., in France, similar presses are now at work, and one has been erected at the Terni Works in Italy, where the forging of guns and armour-plates is largely carried on. A 4,000-ton press, ordered by a Chatillon company, has been delivered, and is now in course of erection by the Leeds firm. As showing how widely the use of the hydraulic power is being adopted, because of its vast capability, it may be mentioned that the Leeds engineers, Messrs. Tannett-Walker & Co., are putting down for the Midland Railway Co., at their goods stations in Birmingham and Leeds (both of which are undergoing large extensions), hydraulic plant whereby more facility than heretofore will be obtained to deal with the immensely increasing traffic.

Swansea Harbour Trust-Rates in the Transatlantic Trade.—At the monthly meeting of the Swansea Harbour Trust on January 12th, the executive committee reported as follows:—"Your committee report that, in consequence of increased cost of labour and coal and working generally, it is necessary to revise the rates charged by the trust to produce additional revenue towards meeting the increased expenditure, and, after careful consideration, your committee recommend that in future steamships sailing for the Atlantic ports of North America be charged 6d. per ton register, instead of 4½d. as at present, the full rate for this class of shipping being 9d. per ton register. Your committee have thought it advisable to increase the consolidated rate on tin-plates shipped from the port from 1s. 3½d. to 1s. 4½d. per ton, and have also made certain increases in the consolidated rates charged for loading and unloading cargoes. Your committee report that the Swansea pilots have applied to the Board of Trade, under the Pilotage Act of 1889, for a provisional order for direct representation of pilots on the pilotage authority, and that by the proposed provisional order it is sought to delegate all pilotage matters to a committee of the trustees. Your committee see no objection to the pilots being represented on the Pilotage Committee, but object to any alteration in the constitution of the trust, and the draft order is in other respects open to objection. Your committee, therefore, recommend that the following gentlemen, viz., the chairman, Sir Hussey Vivian, M.P., Mr. L. L. Dillwyn. M.P., and Messrs. J. Clarke Richardson, and W. Pike, be appointed a sub-committee to watch the order, with power to enter into and conclude such clauses and arrangements as they think fit. The chairman having offered some general remarks upon the report, it was unanimously adopted.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from December 16th to January 15th, 1891.

20035	J. Blake. Steam generators.
20039	J. Whitehead. Steam boiler and other furnaces.
20084	J. B. Edmiston. Purifying feed water for steam boilers.
20135	W. Newlands. Gauge glasses
20137	P. Ferguson and W. Y. Fleming. Multiple expansion steam engines.
20191	C. Latarche. Steam-engines.
20192	J. Gilmore. Feed water heating apparatus for steam boilers.
20213	W. H. Hill and W. Green. Boiler furnaces.
20217	J. B. Barnes. Steam boilers.
20250	J. Westray. Heating appliances for steam boilers
20253	C. E. Austin. Propelling ships
20254	T. Fox. Boiler feed water heaters.
20263	J. Scott and J. R. Scott. Steam boiler furnaces.
20351	W. Dewar. Condensers.
20364	C. L. Jackson. Boilers.
20428	F. Haselden. Screw propellers.
20437	E. C. Urry and G. A. Farini. Steem generators.
20441	L. Ferrari and A. Lepron. Steam engines
20450	C. Ingrey. Steam sirens.
20472	R. Dumas. Slide valves.
20508	H. H. Lake. Thrust bearings (G. F. Simonds, U.S.A.).
20537	A. J. Boult. Marine propulsion (H. Dock, U.S.A.).
20580	G. H. Breton. Automatic lubrication of revolving shafts.
20600	G. Rydill. Steam boilers.
20682	J. Munro. Steam boiler furnaces.
20685	W. Lockwood. Packing for pistons.
20699	R. W. Taynton. Governor for marine steam engines.
20719	J. Blake. Steam generators.
20769	W. M. Smith. Compound engines.
20832	S. Scott. Tubular marine boilers.
20854	J. Cooper. Slide valves.
20855	J. Frew. Equilibrated valves.
20902	C. Wells. Steam engines.
20911	J. L. Mitton. Steam boilers.
20975	D. Stark. Purifying water for steam boilers.
20993	E. Hewett. Side valve for steam engines.
21127	H. H. Lake. Steam boilers (P. C. Platt, U.S.A.).
21161	G. Lawson. Marine engines.
21292	F. R. Lane. Propellers.
1891.	
42	J. Thom. Steam generators.
65	J. Jaques Ships' propellers.
71	C. A. Parsons. Steam boilers.
198	H. Euler. Steam boilers.
440	H. J. Haddon. Removing scales from steam boilers (W. Blackburn, U.S.A.)

BOARD OF TRADE EXAMINATONS.

EXTRA FIRST CLASS,
December 27th, 1890, Hunter, Geo. N., Ex. 1 C, Dundee,

Note.—1 C denotes First Class; 2 C, Second Class.

December 20th, 1890.

Arxott, L. W...	1C	Card
Atkin, Wm. R...	1C	L'pool
Barnes, E. C...	2C	London
Binney, Wm. M.	2C	London
Bland, A. H...	2C	S'thmptn
Bolton, E. J...	1C	N.Shields
Clarke, VdePaul.	2C	Hull
Common, Jn. B.	2C	Cardiff
Dalacherois, R.	2C	Glasgow
Davies, J.....	1C	W. Hrtpl
Davis, James	1C	L'pool
Davies, W. J...	2C	W. Hrtpl
Duff, Edmund	2C	W.Hrtpl
Emmerson R.H.	1C	,,
Eeving, Alex. ..	1C	Glasgow
Gibbs, Sml, J.	2C	Cardiff
Hall, Tom. H...	1C	N.Shields
Harrison, R...	2C	Hull
Hyndman, A.G.	1C	Cardiff
Lane, John....	1C	S'thmptn
Lawson, John	2C	Glasgow
Leach, Fred...	2C	N.Shields
Liddle Henry	1C	,,
Linn, Thos.	2C	Glasgow
McAllister, J...	2C	,,
McBain, P. McV.	2C	,,
Maloney, Jno. T.	2C	L'pool
Pearson, Mattw.	1C	N.Shields
Phillipson C.T.K.	2C	Hull
Ramsey, Wm.	1C	N.Shields
Read, E. H.....	2C	London
Rogers, Robert	1C	Hull
Rowlands, E. T.	2C	L'pool
Stamps, George	2C	Hull
Stamp, Thos...	1C	W. Hrtpl
Stevenson, D. Y.	1C	L'pool
Strong, Robert	1C	L'pool
Vine, John S.	2C	Cardiff
Watson John	1C	N.Shields
Williams, Thos.	1C	L'pool

December 27th, 1890.

Anderson, Alex.	2C	Aberdeen
Anderson, Wm.	2C	N.Shields
Black, Harry, M.	2C	London
Border, Jas. A.	2C	Sndrland
Burnie, Alex. G.	2C	Aberdeen
Candlist, Jno. J.	1C	Sndrland
Clift, Clyde E...	2C	London
Constable, Robt.	1C	Glasgow
Cooper, John H.	2C	Sndrland
Davies, John ..	1C	L'pool
Dixon, James ..	1C	N.Shields
Donaldson, T.D.	1C	,,
Edgecombe, Geo.	1C	Sndrland
Elstone, Athr.E.	1C	London
Embleton, Wm.	1C	Sndrland
Evers, F. H. ..	2C	N.Shields
Greenfield, W.B.	2C	Sndrland
Hart, Walter J.	2C	,,
Hartness, Jno.G.	2C	,,
Lane, George ..	1C	London
Maddison, G. D.	1C	Sndrland
Mearse, Benj. ..	1C	Aberdeen
Mills, John	2C	London
Milne, James ..	2C	N.Shields
Oliver, John W.	2C	,,
Plate, John H..	2C	Sndrland
Ripley, Thomas	2C	,,
Ritchie, James	2C	Aberdeen
Robertson, G. R.	2C	,,
Seymour, Joseph	2C	Sndrland
Shiells, James..	1C	,,
Shimmins, Paul	1C	N.Shields
Smith, James ..	2C	,,
Spain, Robert ..	2C	,,
Spencer, Herbert	1C	Aberdeen
Walkington, Alf.	2C	Sndrland
Ward, Harold H.	1C	London
Whitton, Thos ..	1C	Aberdeen
Wilson, John A.	1C	N.Shields
Wotherspoon, J.D	1C	,,
Young, Tom A...	2C	,,

January 3rd, 1891.

Buchanan, G. ..	2C	Glasgow
Cairnie, Hugh T.	2C	,,
Chalk, Wm. G..	2C	London
Collins, James P.	1C	Cardiff
Cornish, Albt. E.	1C	L'pool
Corry, Alex....	2C	,,
Ferguson, John	1C	Glasgow
Gonrlay, James	2C	,,
Gray, George ..	2C	,,
Johnson, Robt. T.	2C	L'pool
Kendal, Joseph	2C	,,
Krantz, Alex. T.	2C	Cardiff
Munse, Andrew	2C	London
Neist, Thomas..	1C	Glasgow
Paterson, Benj..	2C	Cardiff
Petticrew, Jas..	2C	Glasgow
Ross, William..	1C	,,
Stirling, David	1C	Glasgow
West, Frederick	2C	Cardiff
Young, Hngh ..	1C	Glasgow
Young, William	2C	,,

January 10th, 1891.

Adam, James ..	2C	Greenock
Adams, John E.	1C	L'pool
Bradley, Jph. E.	2C	,,
Brodie, Hugh ..	1C	Leith
Coster, John ..	1C	N.Shields
Cribbers, Geo. ..	1C	Leith
Downie, Andrew	1C	Greenock
Dunn, John	1C	,,
Harvey, David..	1C	,,
Jack, Peter	1C	N.Shields
Jackson, David	2C	Greenock
Kerr, James H.	2C	,,
Laslett, Albt. E.	1C	L'pool
Laurie, William	2C	,,
Lassels, Gilbt.H.	2C	Leith
Lofthouse, A.W.	2C	Greenock
Mitchell, Jno. C.	2C	Leith
Munro, John ..	2C	,,
Nicholson, John	2C	Hull
Porteons, A. N.	1C	Leith
Robson, Wm. H.	2C	N.Shields
Sinclair, Rt. Jno.	2C	,,
Steel, John	2C	Greenock
Storm, Alex. ..	2C	,,
Tinmouth, Geo.	1C	N.Shields
Walker, Arch. M.	2C	Leith
Watson, Wm. ..	2C	Dublin
Williams, Rd. J.	1C	L'pool
Workman, Edwd.	2C	Greenock

January 17th, 1891.

Bell, William ..	1C	L'pool
Bird, Henry ..	1C	N.Shields
Buckmaster, T.W	1C	London
Catto, John	2C	N.Shields
Clark, Alex. ..	1C	L'pool
Cowley, Frdk.W.	2C	,,
Gardiner, Wm.A.	1C	Cork
Isaac, Hugh....	2C	Cardiff
Lithon, James..	2C	Plymouth
Maddison, Geo.	2C	W.H'pool
Mitchell, A. E..	1C	Cardiff
Moor, Walter A.	2C	London
Phillips, Wm. T.	1C	Plymouth
Rayner, Frank	1C	N.Shields
Todd, Wm. B. ..	2C	W.H'pool
Trounson, Saml.	1C	Cardiff
Waugh, W. J. ..	2C	W.H'pool
Whitehead, Wm.	2C	L'pool
Wilson, Jsph. S.	2C	,,

THE "BARRACOUTA."—The new third-class cruiser *Barracouta*,6 has been taken into the steam basin at Sheerness to be completed for commission. The contract with the Palmer Shipbuilding Co. provided that the engines should attain 1,900 H.P. under natural draught, and 3,000 H.P. under forced draught, but a few months ago the Admiralty intimated that if the 1,900 H.P. was obtained on a natural draught trial of eight hours duration, the machinery would be accepted without a forced draught trial. As a mean of 1,920 H.P. was realised at the trial in the North Sea last Friday, the engines and boilers will now be accepted by the Admiralty. The *Barracouta* has fallen short of the expectations of her designers with respect to speed. She was estimated to steam 15 knots, but her average speed for the eight hours run was only just over 13 knots per hour, although at one period she made 15·4 on a run over the measured mile with the tide, and 14·2 knots against it. The cruiser, however, has not been docked for about 18 months, and the state of her keel may have affected herspeed.

The Marine Engineer.

LONDON, MARCH 1, 1891.

THE number of passengers carried between Europe and South Africa has lately increased at so prodigious a ratio that many persons have justly asked whether the leading services of steamers conveying these voyagers are adequate according to reasonable requirements both as regards speed and general accommodation. The better opinion appears to be that they are, but are not likely to be in the near future—say in seven or ten years hence, for the following among other reasons. At present the leading passenger steamers running to the Cape are those of the Union and Castle Lines. The former company have a fortnightly mail service with that port and Natal; a combined Continental and intermediate service from Hamburg, Rotterdam, Antwerp, and Southampton to Cape Town, Port Elizabeth, East London and Natal; and thirdly, an intercolonial mail service taking the mails between the Cape and Natal and proceeding to Delagoa Bay. The steamers on the first of these services leave Southampton for Cape Town every alternate Tuesday and call at Lisbon and Madeira *en route*, they leave Cape Town for Southampton every alternate Wednesday. The time of the voyage between these ports will average about 19½ days. On the combined Continental and intermediate service to the Cape and other South African ports the steamers leave Hamburg every 14 days, calling at Rotterdam and Antwerp alternately, and proceed from Southampton seven or eight days after leaving Hamburg and call at Teneriffe or Grand Canary on the passage. The ships on this service are slower than those on the first-mentioned service and the fares lower. Steamers of the Castle Line run from the East India Dock, in London, every alternate Wednesday, and from Dartmouth on the following Friday for Cape Town and Natal and stop on the voyage at Lisbon and Madeira. Another service of steamships belonging to the Castle Line Co., carrying the Dutch mails, start from London every alternate Wednesday, and call at Grand Canary. These are slower than the steamers which call at Dartmouth. The time of the voyage both out and home, between England and the Cape, has been performed by the steamers of both companies in less than 18 days. The *Dunnottar Castle*, of the Castle Line, which left Dartmouth on the 16th of January last, arrived at Cape Town at 9 a.m. on the 3rd of February. Her nett steaming time was 16 days 2 hrs. 31 min. This is an excellent performance, but it will be eclipsed by the splendid new liner *Scot*, of the Union Line, built and engined by Denny Bros., of Dumbarton, and which was launched on the 30th of December last. She is the largest and fastest steamer built for the South African service, and is estimated to perform the voyage to and from the Cape at an average speed of 17¼ knots. There is likely to be so great a rush of passengers to make voyages by this new ocean greyhound that several of the other steamers belonging to the Union and Castle companies, running on the same route, may not carry anything like the number of passengers they otherwise would do. Many leading members of the shipping community, therefore, think the possession of only one very fast steamer by either of these companies must be considered in the light of a white elephant. As 20-knot steamers are running across the Atlantic, to and from New York, and several of 17 knots to and from Australia, it is considered reasonable to believe that in another seven or ten years, owing to the further great increase of passenger traffic between Europe and the Cape, and further exactions below the customary time in transit between them, that a weekly service of steamers, equal at least in speed and accommodation to the *Scot*, will be run between the Cape and English ports. Many persons are looking forward to the time when the voyages between Cape Town and Southampton and *vice versâ* will be performed in a fortnight. This expectation is not an irrational one when it is considered that steamers of only high second-class speed would be required to accomplish this desideratum.

THE papers that have been read before the N. E. Coast Inst. of Engineers are certainly of an interesting character. We are often apt to think that the special *forte* of marine engineers is practically hard-headed work, on generally recognised lines of construction, without much independence of thought or dabbling in theory. But this is far from being the aspect presented by the papers read before the above institution. Many points of importance, and much bold theoretical suggestion has been offered for the consideration of the members of this institution. A paper read by Mr. William Russell Cummins on "Increased Boiler Pressure and Increased Piston Speed for Engines" is one that merits attention, and is full of bold suggestion. The object of this paper was to raise questions as to the advisability of increasing the working pressure and the piston speed of marine engines, and to consider what type of engine and boiler would best suit under these conditions. Mr. Cummins must be complimented upon his undertaking to enlighten his fellow engineers with a suggestion based on theories that are still so much in dispute, and which form still such debatable ground in the theory of the steam-engine. He naturally advocates a still greater range of initial pressure, and as great a range of expansion as 28 times, and argues theoretically that a proportionate increase of economy would be thereby secured. No one can have any doubt that where the same weight of steam is used for an expansion of 18 times on the one hand as compared with 28 times on the other, the indicator diagrams will certainly show a greater proportion of indicated work obtained per lb. of steam. But this is only the elementary ground of such a subject, and there are many practicable difficulties and theories to be considered in association with such an idea. To begin with, high ranges of expansion certainly mean great variation between maximum and minimum pressure, and the reduction in the gross work obtained from any given weight of material, and would be only possible in the high ranges mentioned in triplex or quadruplex compounded engines. The multiplication of cylinders thus arranged necessitate no doubt an increase of the gross amount of friction and leakage through the many glands and working faces, which may be to some extent avoided in single or double cylinder engines. There is likely thus to be a limit, as the theoretical economy increases in the high ranges of expansion very slowly, when the frictiona and leakage losses, and the increase in weight of material more than counterbalances any further economy obtained in the expansive use of steam. There is also another curious, but positive, limit to the actual economy in using extreme rates of expansion, and this is found by having regard to the proportion of dead load, as compared with live load, in any engine; that is to say, it is well known that in any marine engine the actual effective work of propulsion is less than the I.H.P. developed in the cylinders by say 25 or 30 per cent., which latter proportion of the whole work done must therefore be considered as operating upon dead load, such as frictional resistances, before any effective work can be obtained. We submit as a common-sense proposition to engineers that when an engine has ceased to effect any indicated work beyond the average amount of dead load, from that point the engine is effecting no useful purpose, as there is no margin to do effective work. It may be thought this is an impossibility, or otherwise the engine when it has reached the limit of the dead load would cease to drive, and draw up. But this is not so. In all single-cylinder land engines the engine could depend upon the momentum of the fly-wheel, or other rotating machinery, to carry on the movement of the engine to the completion of the stroke, some time after the development of work in the cylinder has dropped under the amount required to operate the dead load. In the case of marine engines cylinders are combined or compounded so that when one cylinder is at its minimum, another cylinder is at its maximum effort, and the regular rotation is thus maintained where one or more cylinders are actually doing less than that which is necessary to operate the dead load. In both of these cases that part of the revolution which is continued after the effective work has dropped below the minimum average required for dead load. The revolution is completed at the expense of those cylinders, or that part of the stroke in which the effective indicated power is greatly in excess of the dead load, the effectiveness of which is thereby robbed by reason of the ineffectiveness of the latter part of the stroke. It is probable that the combination of cylinders, now so generally adopted in quadruple, compounded engines, will always serve to keep up the average effective work, which they develop as a combination, above the minimum of the dead load, but the mutual robbing between the ineffective and effective cylinders still goes on. We may therefore, without hesitation, say that there is a practical limit to economical expansion, though theoretically the indicator diagrams will show on the whole a larger percentage of work done in the cylinders with extreme rates of expansion than with middle rates. This is no guess theory, but has been proved, to our knowledge, to be a fact in relative test trials between the portable and other engines for maximum effective work from a minimum consumption of fuel. It has, in this case, been found that no practical economy was effected beyond certain very moderate rates of expansion No doubt great increases of initial pressures have enabled much higher rates of expansion to be practicable and economical as compared with former rates of expansion on lower pressures, but we would submit that if high ranges of expansion have already been used up to the limit we have above described, it does not follow that still higher ranges of expansion, though showing greater economy upon the indicator diagram, will really result in better work per weight of fuel consumed.

THE forthcoming Atlantic season promises to be one of keen competition between the several companies engaged in the swift mail and passenger service, and, more than in previous seasons, the contest will be marked by the additional element of rivalry as between vessels of British and Continental build. Another proof of the advance Continental countries are making in mercantile shipbuilding is found in the new North German Lloyd steamer *Havel*, just placed on the

Bremen, Southampton, and New York service. This vessel, which is about 9,000 tons register, and resembles the Cunard liner *Etruria* in size and power of engines, was built by the Vulcan Co. at Stettin, where lately a number of fast vessels have been produced. She is sister to the *Spree*, which was put upon the service in October last, and like her, differs from all recent powerful high-speed Atlantic steamers in being driven by a single screw. These vessels are 465 ft. long, 52 ft. beam, and 38 ft. deep, moulded, and have accommodation for 244 passengers in the first saloon, 122 in the second, and 460 third-class passengers, and officers and crew to the number of 240. The engines, of the triple-expansion type, have cylinders 38 in., 75 in., and 100 in. in diam., the stroke being 6 ft. and the steam pressure 165 lbs. per square inch. Steam is supplied from ten steel boilers, six of which are double-ended and four single-ended. All the boilers are 15½ ft. in diam., the length of the double-ended being 18 ft. 8 in., and of the single-ended 10 ft. 4 in. The propeller is of manganeze bronze, having four blades, the overall diameter being 21 ft. 7 in., and pitch 31 ft. 4 in. Great things are expected from these vessels, the trial trip speed of the *Spree* having been considerably over 20 knots, with 13,000 I.H.P. As yet she has not been beaten by the *Lahn*, built in 1887 by the Fairfield Co., and when it is considered that the engine power in the case of the latter is only about 10,000 I.H.P., there is little likelihood that the British-built boat will seriously rival her German companions. Whether any of the more recent productions from the Fairfield stocks owned by the same company will hold their own with the Stettin racers will certainly be a question which will force itself on the attention of many in this country, as the result is fraught with great consequences to one, if not several, of our British building firms. The North German Lloyd Co. having now a sufficient number of first-class steamers for a tri-weekly express service between Bremen, Southampton, and New York, have decided to despatch, during the coming season, steamers from Southampton to New York on Wednesdays, Thursdays, and Sundays, after the 7th of March. Two other vessels, to be added shortly to the Atlantic fleet, will also be of Continental build. The Hamburg-American Co., who got their last vessel, the *Normannia*, from Fairfield, will place a fourth fast steamer on their Southampton and New York service on the 9th May, when the *Fuerst Bismark*, a 9,000-ton vessel of German build, will make her maiden trip. The construction of this vessel, it may be of interest to state, was begun almost simultaneously with the *Normannia*, which has now been running for about a year. The guaranteed speed of the new vessel is about 20 knots, and horse power of engines 16,500 indicated. The passage from Southampton is 6 days 14 hours, and the four Hamburg-American vessels will have a lively time amongst themselves and with the new North German Lloyd steamers during the coming season. With regard to vessels on hand and completed, it may be stated that the Forges et Chantiers de la Mediterranée at Havre are progressing, though slowly, with the large steamer *La Touraine* for the Compagnie Generale Transatlantique. This vessel is larger than the four fast vessels of the fleet at present, and she will have two-thirds more power, or 12,000 I.H.P. The Cunard Co., consistent to the last in their policy of "waiting," have been watching events keenly, and are now preparing to place one, if not two, new "flyers," which will doubtless show a "clean pair of heels" to the whole crowd of greyhounds, British and Continental. The contract for these is not yet definitely fixed, but there seems little doubt that it will be entrusted to a Clyde firm. In any case the Cunard Co. are sure to reap the benefit of experience from another, and to all appearances a keen, season's rivalry in Transatlantic steaming.

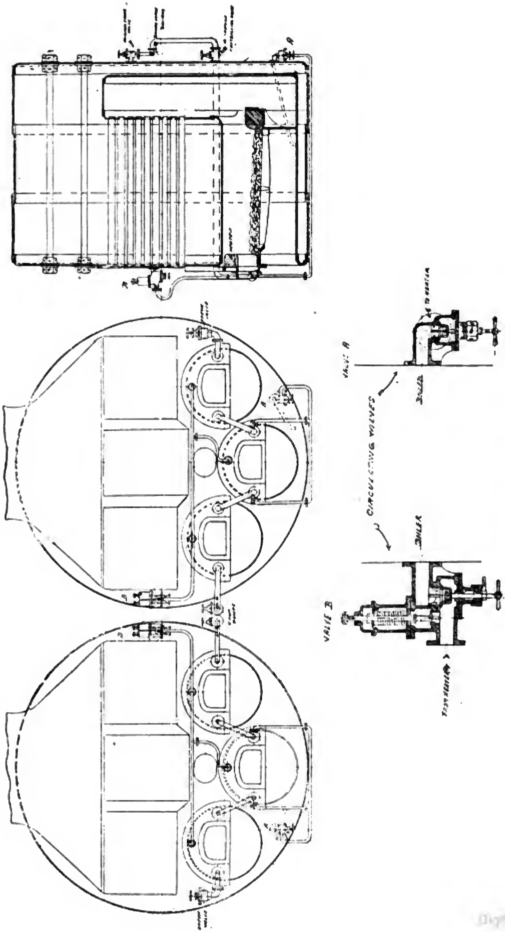
THE "PYROS" AUTOMATIC FEED HEATER AND CIRCULATOR.

THE "Pyros" combination, which we here describe and illustrate, is an ingenious device designed to raise the efficiency of boilers to a much higher point than is at present attained, as well as to lengthen their lives.

We take it for granted that one of the most important points, in working a boiler, is to avoid the various stresses on the shell arising from unequal temperatures. Wherever this inequality of temperature exists the result is that severe strains are set up and ultimately defects of a more or less serious nature are developed, the consequence being a materially shortened life for the boiler. These stresses can be avoided by a perfect circulation.

To attain this desirable end, many devices have been tried. Among them, taking steam from auxiliary sources and putting it into various parts of the boiler direct; feeding with injectors; circulating by pumps, &c., &c., and while some of these have displayed considerable ingenuity, and been attended with more or less success, yet abundant room was left for improvement. It is claimed that by fitting the "Pyros" combination, a boiler is made what it always should have been—a self-contained instrument capable, by its own action, of counteracting the evils complained of during the raising and lowering steam.

It consists of removing the present furnace fronts and substituting iron or steel heaters of the same strength as the boiler itself, and of about the same depth as the dead plate, while at the same time in no way interfering with the grate surface. These heaters or chambers are filled with water from the bottom of the boiler, or at any point where there is no circulation. The fires are laid in the usual way, but preferably with small coals for two-thirds of the length of the furnace. On the remainder active combustion takes place, the radiated heat from which impinges on the back of the heaters and causes circulation in them, instead of, as at present, escaping into the stokehold. As this circulation goes on, the cold water is displaced and delivered into the boiler at near the working water level. This circulation goes on until a uniform temperature throughout the entire boiler is attained, and during this process there is neither pressure nor steam used, and no stresses can exist, as



The "Pyros" Automatic Feed Heater and Circulator (see page 507).

the temperature in all parts is uniform before steam is actually raised. When it has been ascertained that the temperature is equal, the fires are spread and steam is got.

When the heaters have done their work as equalizers, they become auxiliary boilers, assisting the larger one. The feed-water, instead of going into the boiler direct, is diverted into these heaters, and becomes heated to a mean of 220° Fahr., simply by the radiant heat which, as we have said, would otherwise pass unutilized into the stockhold. No steam is used in the operation, in fact no part of this system has any connection with the steam space or any steam pipe, so that its use is impossible.

Our illustration shows the front end of two boilers fitted with the "Pyros," and a section through one of them, which sufficiently explain themselves. The cold water, or that where there is no circulation, is drawn from the main boiler at A, and after passing through the three heaters is returned at B. We also give enlarged sections of the valves at A and B. These valves are of a special design, so that in the changes necessary for any operation they do not require any manipulation, as they are absolutely automatic.

We should mention that in the use of the heaters as feed supply, that as the old arrangement still stands, it can be fallen back on should any defect arise in the new arrangement.

The advantages claimed for the "Pyros" are solid and substantial. First, a great saving of coals—from 6 to 10 per cent., arrived at by the utilising of what otherwise would be waste heat. Second, no renewals of fire doors, check or baffle plates. In some of the Atlantic greyhounds these items are very expensive ones, but with this system they are all dispensed with. Third, the complete absorption of the heat reduces the stockhold temperature by something like 27° Fah., and not only making a cooler stockhold, but a cooler ship, and consequently a cargo less liable to damage from heat; and in the case of war vessels where the stockholds are below the line of fire of very great importance indeed. Fourth, but not second in importance, a decided prolongation of the lives of boilers owing to the absence of abnormal stresses.

These claims have all been realised and based on the results actually obtained after nearly two years' work in the s.s. *Cardiganshire*, a steamer of the ordinary cargo type, on natural draught. With any description of forced draught the result must be still more economical.

The steamer selected for the trial is a vessel engaged in the China and Japan trade, of 3,700 tons deadweight. She steams about 10 knots, and is fitted with compound engine, indicating 1,250 H.P. ordinary work at sea. She has two boilers 15 ft. 1 in. diameter, and 10 ft. 6 in. long, with safety-valve loaded to 90 lbs., and each boiler has three furnaces 3 ft. 8 in. diameter, and 7 ft. 6 in. long, and a total of 484 tubes for both. The grate surface is 132 square feet and the heating surface 4,185 square feet. We give tables showing (1) mean coal consumption on five voyages before the "Pyros" was fitted, compared with voyage No. 6 with one boiler fitted with the "Pyros," and voyage 7 with both boilers so fitted; and (2) difference of coal consumption per day and relative money value of saving:—

(1) Mean of Five Voyages compared with Voyages 6 and 7.

	Five Voyages.				No. 6.				No. 7.			
Time under steam ..	Days. 110	Hours. 1			Days. 107	Hours. 0			Days. 111	Hours. 17		
Coal consumed ..	Tons. 2677	Cwts. 15			Tons. 2499	Cwts. 0			Tons. 2438	Cwts. 14		
Aver'ge consumption per day ..	Tons. 24	cwts. 7	qrs. 0	lbs. 12	Tons. 23	cwts. 7	qrs. 0	lbs. 11	Tons. 21	cwts. 16	qrs. 2	lbs. 16

	Tons.	cwts.	qrs.	lbs.			
(2) Difference of coal consumption per day between five previous voyages and No. 6 .. .. =	1	0	0	0	£101	5	7
Ditto ditto ditto and No. 7 =	2	10	1	24	272	10	1
				Total	£373	15	8

These particulars are taken from abstract logs and log books.

It will be seen that the saving here effected is fully 7½ per cent.

The working of this system maintains an almost absolute equality of temperature in the boiler under every condition. The apparatus has every feature of safety, the heaters are made of the best brands of iron or Siemens-Martin steel, and of the same strength as the boiler, they do not interfere in any way with the efficiency of the grate surface, no pipes or any complication whatever in the furnace or ash pits, no structural alteration necessary, can be fitted to nearly every description of boiler in a few days.

The Patentee is Mr. C. E. Hudson, of Woodlands, Disraeli Road, Forest Gate; and the makers and fitters are Messrs. A. W. Robertson & Co., engineers and shipbuilders, Custom House Works, Victoria Docks, London.

INCREASED BOILER PRESSURE AND INCREASED PISTON SPEED FOR MARINE ENGINES.[*]

By William Russell Cummins.

(Concluded from page 494).

As regards the third cause of the economy of the triple-expansion engine, viz., increased piston speed, the advantage of this is evident. Take the case of two identical engines, both however, running at twice the number of revolutions of the other. The amount of steam condensed will be the same in both engines, but the proportion of steam condensed to steam passing through the engine (which measures the loss) will be very much less in the fast running engine. Thus an increase of revolutions should always tend towards economy of steam. The increase of piston speed in the case of the triple-expansion engine compared with the compound has not, however, been very great. As pointed out before, the economy of steam of 150 lbs. pressure is 18 per cent., assuming the boiler efficiency to be the same in both cases.

The generally admitted economy of the triple-expansion engine is 20 per cent., from which it would appear that the economy has been mainly due to the increase of the working pressure and increased expansions, and that the effect of the decreased temperature range in the cylinders and increased piston speed has in this case been inappreciable. Using the formula as given before for calculating the efficiency of steam of 220 lbs. absolute pressure expanded to 5 lbs. absolute, we have—

T_1 = 851·04 degs. Fah.,
T_2 = 623·53 degs. Fah.,
H_1 = 646423 ft. lbs.
H_2 = 772561 ft. lbs.,

and the proportion of steam liquefied at the end of the expansion = 19·32 per cent. The weight of initial steam—

$$= 1 \times \frac{\text{total heat of steam at 115 lbs. absolute pressure}}{\text{total heat of steam at 220 lbs. absolute pressure}} = {\cdot}98713$$

lbs.; so that, at the beginning of expansion, we have ·98713 lbs steam at 220 lbs. absolute pressure, and at the end of expansion ·79642 lbs. steam at 5 lbs. absolute pressure and ·19071 lbs. water. Heat received = total heat of 98713 lbs. steam at 220 lbs. absolute pressure = 1216·974 thermal units. Heat rejected = total heat of ·79642 lbs. steam at 4 lbs. absolute = 924·344 thermal units + heat of ·19071 lbs. water at same temperature = 29·254 thermal units. 924·344 + 29·254 = 953·598 thermal units rejected.

1216·974 — 953·598 = 263·376 thermal units utilised.

Thermal units utilised by steam of 165 lbs. absolute pressure = 237·345.

$$\frac{263{\cdot}376 - 237{\cdot}345}{237{\cdot}345} \times 100 = 10 \text{ per cent. economy of}$$

steam of 220 lbs. absolute over steam of 165 lbs. absolute pressure.

For steam of 265 lbs. absolute pressure expanded to 5 lbs. absolute—

T_1 = 867·04 degs. Fah.
T_2 = 623·53 degs. Fah.
H_1 = 637267 ft. lbs.
H_2 = 772561 ft. lbs.

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[*] Read before the North-East Coast Institution of Engineers and Ship builders.

The proportion of steam liquefied at the end of expansion is 20·17 per cent.

Weight of initial steam—

$$=1\times\frac{\text{total heat of 1 lb. steam at 115 lbs. absolute pressure}}{\text{total heat of 1 lb. steam at 265 lbs. absolute pressure}}=\cdot98323$$

lbs. steam at 265 lbs.; so that, at the beginning of expansion, we have ·98323 lbs. steam at 265 lbs. absolute pressure, and at the end ·78492 lbs. steam at 5 lbs., and ·19831 lbs. water. Heat received = total heat of ·98323 lbs. steam at 265 lbs. absolute pressure = 1216·974 thermal units. Heat rejected = total heat of ·78492 lbs. steam at 4 lbs. = 9109·97 thermal units + heat of ·19831 lbs. water at same temperature = 30·419 thermal units. 910·997 + 30·419 = 941·417 thermal units rejected.

$$1216\cdot974 - 941\cdot417 = 275\cdot557 \text{ thermal units utilised.}$$

Thermal units utilised by steam of 165 lbs. pressure = 237·345.

$$\frac{275\cdot557 - 237\cdot345}{237\cdot345}\times 100 = 16 \text{ per cent. economy of}$$

steam of 265 lbs. absolute pressure over steam of 165 lbs. absolute pressure.

If, taking into consideration the gain of 16 per cent. in steam economy and the admitted economy of high piston speed, it is deemed advisable to increase the boiler pressure to 250 lbs. per square inch, and also to increase the piston speed, the next question to be decided is—What type of engine will best suit these new conditions?

There are several types of engine which could be adapted, viz., two-crank four-cylinder tandem, two-crank three-cylinder tandem, three-crank three-cylinder, and four-crank four-cylinder. The two first are not at all suitable for high speeds, so that the choice lies between the two last.

In the first place, the four-cylinder type has an advantage over the three-cylinder type in the matter of steam distribution, as the cut off must be much earlier in the three-cylinder engine. This early cut off, besides making the engines unhandy, only allows of a small valve opening, thus necessitating a large travel to get the requisite steam opening. The travel of the valves is limited by the length of the cylinders, the limit being often reached with engines of the present type.

As regards the maximum piston speed at which the two types could be run, the three-cylinder engine would have a greater initial pressure to counterbalance the inertia of the moving parts; but on the other hand, the four-cylinder engine having less initial pressure, would have less weight of moving parts. As, however, the weight of the moving parts is proportional to the initial load, the maximum piston speed will be the same for both types. Another advantage of the four-crank type is, that only two sets of valve gear are required; so that, on the whole, it would appear that the four-crank four-cylinder type of engine will be the most suitable for the new conditions.

There are two important limits to the number of revolutions at which an engine can be run. The first limit is reached when the pressure per square inch of piston required to accelerate the reciprocating parts at the beginning of the stroke is equal to the pressure of the initial steam.

"Pounding" at the end of the stroke happens when the centrifugal force of the reciprocating parts is greater than the force exerted by the steam of initial pressure on the other side of the piston, so that at the end of the stroke there is an unbalanced force causing a shock, which is immediately followed by another shock produced by the steam of initial pressure taking up the "play" of the brasses. When an engine is working smoothly, the pressure of the steam being compressed behind the piston, assisted by the "lead," is enough to overcome the inertia of the reciprocating parts before the crank is on its centre, so that there is no jar at the end of the stroke.

The second limit to the number of revolutions is imposed by the "swing" of the connecting rod. At or about half-stroke the transverse motion of the connecting rod is changed in direction, so that at that point the connecting rod will exert a force on the crosshead, tending, on the upstroke, to increase the pressure on the guide, and on the downstroke to decrease the pressure on the guide. On the upstroke this increase of pressure can be taken up by an increase of guide surface. On the downstroke, however, the connecting rod decreases the pressure on the guide, and if the revolutions were sufficiently high, the slipper would leave the "ahead" guide and come up against the "astern" guide. Under these conditions it is very [illegible] the piston rod would heat, so that the limit of revolu[illegible]d be reached when the force exerted by the connect[illegible]he crosshead was equal to the pressure on the guide.

We now pass on to the design of the cylinder ratios, etc., for the new pressure, after which the revolutions may be fixed.

The usual method of designing cylinder ratios, points of cut off, &c., is to arrange that the I.H.P. developed in each cylinder should be the same. The I.H.P of each cylinder being the same, the initial loads may or may not be equal (in most cases they are not equal), and since the piston rods and connecting rods are always in duplicate, it follows that they must be designed to transmit the highest of the initial loads.

The writer ventures to suggest that cylinder ratios, &c., should be designed so as to obtain equal initial loads in each cylinder. By this method the greatest economy is obtained in the weight of the reciprocating parts, a very important point in high speed engines. The method used in the present instance has been to combine actual diagrams from a triple-expansion engine of 160 lbs. boiler pressure (see Fig. 3, Plate I.).

Since the diagram is for comparative purposes only, the cards have been set off without taking account of clearance and compression, and the steam curve continued up to 265 lbs. pressure, has for the sake of simplicity, been plotted as a constant weight curve. The back pressure has been taken at 3½ lbs. on the low-pressure piston. The ratios for the triple have been so arranged as to give equal initial loads with a minimum of "drop" between the cylinders.

It will be seen from the diagram that there is a considerable "drop" between the first and second cylinders. This is owing to the necessity of keeping the first cylinder small, so that the cut off need not be too early. The quadruple has been arranged on the same method. It will be noticed that the drop between the cylinders is very small.

The loss from drop is represented very nearly by the area of the triangular piece A B C. A certain quantity of heat is, however, regained, as the steam on expanding into the receiver, without doing work, will, if dry, become superheated, or if it contains suspended water, a portion of it will be evaporated, and become available for doing work in the next cylinder, from which it will be seen that if a drop cannot be avoided, it will be best to arrange it at the higher pressure, so that the greatest amount of heat may be regained, as the farther the expansion is carried the greater the amount of heat regained. It may be argued that with large "drops" smaller cylinders may be used, consequently the engines would weigh and cost less. The most economical amount of drop will be reached when the percentage of loss caused by any further "drop" is greater than the percentage of weight saved by using a smaller cylinder.

These same considerations apply to the most economical number of expansions of the steam. By increasing the number of expansions more work is obtained from the steam; but at the same time the engines will be larger, and the limit to the number of expansions will be reached when the percentage of gain due to any further increase of expansion is less than the percentage of weight added to the engines.

Coming back to the diagram, it will be seen that the cylinder ratios of the triple are—1 : 2·04 : 6·54, and for the quadruple—1 : 2·08 : 4.46 : 10·47.

It will be noted that, according to the diagram, the volume of the low-pressure cylinder is the same for both engines. It is probable that actually the low-pressure cylinder of the quadruple will have a greater volume; this, however, will not introduce any appreciable error into the calculations.

For facility of comparison, let us take as an example a triple-expansion engine of $\frac{28'' \times 40'' \times 71''}{48''} \times 150$ lbs. pressure; revolutions = 65 = "normal" revolutions of the Institution's Rule, and arrange the corresponding quadruple to develop the same H.P. The first point is to decide upon the stroke of the quadruple. It will be of advantage to keep the stroke as long as possible, as the longer the stroke the greater the piston speed with "normal" revolutions; besides which long strokes and consequently small diameters of cylinders will save space longitudinally, the height of the engines being in merchant vessels generally of little consequence. Let the stroke of the quadruple, then, be taken at 48 in., same as the triple. To determine the number of revolutions, let it be assumed that the engines can be run safely and smoothly when the initial pressure is equal to the pressure required to absorb the inertia of the reciprocating parts at the end of the stroke, and when there is a margin of pressure, always keeping the slipper on its guide.

Let w = weight of reciprocating parts per square inch of piston.
n = number of revolutions per minute.
r = radius of crank in feet.
c = length of connecting rod in feet.

The weight of the reciprocating parts per square inch of piston will probably be—

For 1st cylinder = 7·5 lbs. per square inch.
" 2nd " = 4·0 " "
" 3rd " = 2·5 " "
" 4th " = 1·8 " "

The pressure per square inch of piston required to accelerate the reciprocating parts at the beginning of the stroke—

$$p = {\cdot}00034 \times w \times n^2 \times r \times \frac{C+r}{C} - w \text{ for top centre.}$$

$$p = {\cdot}00034 \times w \times n^2 \times r \times \frac{C-r}{C} + w \text{ for bottom centre.}$$

In our case—

p = 146 lbs. per square inch for 1st cylinder.
= 70 " " " 2nd "
= 32·5 " " " 3rd "
= 14·0 " " " 4th "

Limit of revolutions—

1st cylinder	top	156 revolutions.
	bottom	188 "
2nd cylinder	top	148 "
	bottom	178 "
3rd cylinder	top	104 "
	bottom	151 "
4th cylinder	top	101 "
	bottom	115 "

This practically limits the revolutions to 100 per minute.

No account has yet been taken of the inertia of the pumps. If the pumps are worked off the fourth cylinder, the revolutions must be reduced, if the pressures in the pumps themselves are not sufficient to overcome the inertia of the moving parts.

For the second cylinder—

$$p = 70 = {\cdot}00034 \times w \times 100^2 \times 2 \times 10{\cdot}5 - 4.$$

$$w = \frac{74 \times 8{\cdot}5}{{\cdot}00034 \times 100^2 \times 2 \times 10{\cdot}5} = 8{\cdot}8 \text{ lbs. per square inch of piston.}$$

Weight of piston, connecting rods, &c. = 4 lbs. per square inch of piston; so that the steam in the second cylinder would balance 8·8 — 4·0 = 4·8 lbs. of pump gear per square inch of second cylinder = ·95 lbs. per square inch of fourth cylinder. The actual unbalanced inertia will probably not be more than this, so that the engines can still be run at 100 revolutions if the pumps are driven from the second cylinder.

We have next to consider the other limit of revolutions—viz., the momentum due to the transverse motion of the connecting rod. This has been estimated in the following manner:—The path described by the centre of gravity of the connecting rod being traced out, an arc of a circle is found which will coincide as nearly as possible with the curve at half-stroke. The centre of gravity of the rod is assumed to be rotating on the radius thus found.

This is perhaps not a strictly accurate solution of the problem, but will be sufficiently near for the present purpose.

In the case under consideration the weight of the connecting rod proportioned for a 71 in. cylinder = 2,100 lbs.; length = 8 ft. 6 in.; centre of gravity, 43 in. from bottom end; radius of arc coinciding with path described by centre of gravity at half-stroke = 3·6 ft.; so that the centrifugal force exerted by the rod will be—

$$ {\cdot}00034 \times 2100 \times 100^2 \times 3{\cdot}6 = 25{,}700 \text{ lbs.}$$

This is equivalent to 10,400 lbs. acting at the crosshead.

The pressure on the guides

$$= \frac{\text{Area } 71'' \times 14 \times 2}{8{\cdot}5} = 13{,}000 \text{ lbs.;}$$

so that at 100 revolutions there is still a margin of 2,600 lbs. to keep the shoe on the guide.

Assuming that by the increased working pressure and increased piston speed an economy of, say, 10 per cent. can be effected, the size of the low-pressure cylinder of the quadruple to develop the same I.H.P. as the triple we have taken as an example, will be—

$$\frac{\text{Area } 71'' \times {\cdot}9 \times 65}{100} = 2{,}316 \text{ square inches} = 55 \text{ inches diameter.}$$

The cylinder ratios, as determined before by the diagram, Fig. 3, Plate I., are—1 : 2·08 : 4·46 : 10·47, so that the quadruple engines will be—

$$\frac{17'' \times 24\tfrac{1}{2}'' \times 36'' \times 55''}{48''} \times 250 \text{ lbs. boiler pressure.}$$

Revolutions per minute = 100.

The size of the triple engine which it is to replace being—

$$\frac{28'' \times 40'' \times 71''}{48''} \times 150 \text{ lbs. pressure.}$$

Revolutions per minute 65.

The writer would suggest that separate steam and exhaust valves, of the piston type, be adopted, for two reasons, first, because by these means the steam chests can be so arranged that steam of higher pressure does not transmit any of its heat to steam of lower pressure. If, as pointed out before, a certain number of thermal units at a high temperature are more valuable than the same number of thermal units at a lower temperature, and economy should result from the proposed arrangement. The second advantage of separate valves is, that they may be made multiple ported, thus economising weight and space occupied.

Only two sets of valve gear will be required to work all the valves, and the sequence of cranks should be so arranged that the crank of the first cylinder is at right angles to the crank of the second, and so on all through. This is in order to keep the exhaust line parallel with the atmospheric line. With the cranks opposite one another, the exhaust line, at the ends of the stroke, will be below the mean exhaust line, with the result that the initial load will be increased by that amount.

To sum up, the writer has endeavoured to show that the economy of the three-crank triple-expansion over the two-crank compound has been mainly due to the increase of boiler pressure, and, to a small extent, to the increase of piston speed. That by increasing the boiler pressure to 250 lbs. per square inch a steam economy of, say, 15 per cent. can be obtained over the present three-crank triple. That an increase of piston speed, besides increasing the economy of steam, will also increase the weight economy, so that the piston speed should be increased up to the limits set down in the paper. That the best type of engine to use this higher pressure, and best adapted to run at high speed, is the four-crank four-cylinder engine, with unjacketed cylinders and separate steam and exhaust valves.

Passing on to the question of the type of boiler to be adopted, the writer is of opinion that a considerable departure from the present design of boiler is necessary in order to make a satisfactory structure for 250 lbs. pressure. With this pressure difficulties will arise with the furnaces, and the flat sides of the combustion chambers. To get over these difficulties the writer proposes to put the furnaces and combustion chambers outside the boiler altogether. The boiler then becomes a simple cylinder, the tubes running from end to end. As shown in the drawing (Plates II. and III.), the boilers are arranged back to back, with the combustion chambers between them. The furnaces and combustion chamber may be of cast or wrought-iron, lined with firebrick. In order to keep down the grate surface, and thus economise space athwartships, it will be of advantage to use forced draught, and all the air on its way to the furnaces is made to pass over the top and sides of the combustion chamber, thus reducing to a minimum any loss from radiation.

The advantages of a boiler of this type are obvious. It is perfectly suitable for a high pressure. There will be no straining from unequal temperatures. The cost of manufacture will be considerably less than that of the present type of boiler. For the same heating surface the space occupied is less; the boiler shown on Plates II. and III. is 10 ft. 6 in. diameter, and contains the same heating surface as a boiler of the present type 13 ft. 6 in. diameter, the lengths in both cases being the same.

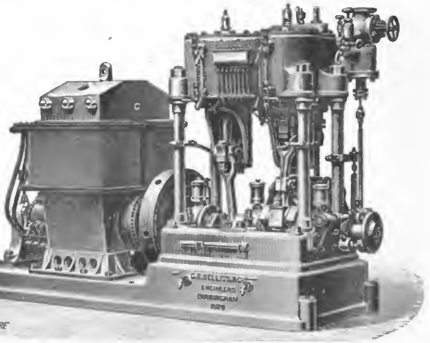
A COMMITTEE of engineers is about to assemble at Calcutta, to report on the condition of the new docks at Kidderpore. The Indian and Bengal Governments and the Chamber of Commerce will each nominate a representative.

OPEN DIRECT-ACTING "NAVY" TYPE DYNAMO ENGINE.

Owing to the difficulties which have so frequently occurred with the closed type of engines formerly used almost exclusively in the Navy for electric light machinery, the Admiralty have abolished them in their recent ships, and have substituted open engines of the compound type. Our illustration shows one of a set of nine, which Messrs. G. E. Belliss & Co., of Birmingham, have recently completed for the new battleships. The firm have already supplied during the last year or two (since the open type of engine has been adopted) about twenty of these sets of dynamo machinery for various ships of our Navy, including H.M.S. *Nile*, *Sanspareil*, *Phœbe*, *Alexandria*, *Defiance*, *Royal Oak*, *Resolution*, and *Revenge*, and the official trials at Portsmouth have given complete satisfaction.

The engine is well balanced, the cranks being opposite and the valves arranged to give the amount of compression required for economy and quick running. The makers have aimed at making an engine capable of running for long periods without requiring adjustment, and with such simplicity of parts as shall render the liability to damage as small as possible, and give the utmost facility for adjustment or repair. The cylinders are supported on four stout steel columns, fitted into long sockets accurately bored to correspond in cylinder and bedplate. The guides are carried on the cylinder casting, and are designed to be very readily adjusted. The piston valves are placed at the back of the engine and driven by a single lever arrangement from the H.P. connecting-rod. The governor is placed at the end of the crank-shaft, and is capable of controlling the engine to within 3 er cent. of the maximum revolutions when the full ad [illegible] own suddenly off. The engine and dynamo are carried upon a combination baseplate, and each set is subjected to thorough working tests at Messrs. Belliss & Co.'s works, where a very complete installation of electrical resistances and recording instruments have been fitted for the purpose. In addition to these, each set supplied for service in our Navy is subjected to official tests at Portsmouth Dockyard for six hours continuous running at full power with a guaranteed minimum consumption of water per E.H.P. per hour' and the effectiveness of the governor and general perfectness of the whole construction and suitability for the service are determined.

The illustration shows an engine in combination with a "Siemens" dynamo, but dynamos of other design and construction are fitted by Messrs. Belliss & Co. to their engines as may be required. We understand that they purpose to exhibit at the forthcoming Naval Exhibition some of their specialities in these things, and we have no doubt the simplicity and excellence of the design will attract the attention of all who are interested in this department of engineering.



INSTITUTE OF MARINE ENGINEERS.

A MEETING of the Institute of Marine Engineers was held at the Langthorne Rooms, Stratford, on January 27th, Mr. F. W. Wymer presiding.

The paper on "Capital and Labour," read by Mr. F. W Shorey at the previous meeting, was further discussed.

The chief point of interest in the paper was a proposed system of "profit sharing," designed to ensure that each man should do his best for the success of the business in which he was engaged.

Previous to the discussion on the above paper a social meeting and conference was held by the members of the Council, and a deputation of members from the Bristol Channel, consisting of Professor Elliot, Messrs. John, G. E. Fownes, and C. Elms. Professor Elliot explained the purpose of the meeting and spoke of the enthusiasm with which the objects of the Institute were carried out in their district, and hoped for an opportunity to welcome London members to Cardiff. The meeting was productive of a cordial feeling between members, that as the Institute is of national importance, the objects will be best carried out by a good feeling amongst its members tending to the improvement of the status of the marine engineer, on whom rests the great responsibility of carrying out his duties successfully for the safety of travellers by sea. Mr. J. McF. Gray mentioned that he had heard some flattering remarks from several quarters, approving of the Institute's doings, and the discussions on the various papers which had been reported in the technical journals.

The meetings closed with votes of thanks to the leading members.

BRISTOL CHANNEL CENTRE.

WE notice with pleasure and satisfaction that the Senators of the University College of South Wales and Monmouthshire have granted free use to the members of the Bristol Channel Centre of the Institute of Marine Engineers for the purpose of meetings certain rooms in the University College, Cardiff.

A resolution was passed at a meeting of the local members of the Institute in Cardiff to the effect, "that the best thanks of the Institute of Marine Engineers be given to the Registrar and Council of the University College of South Wales and Monmouthshire for granting us the free use of rooms in the College for the purpose of holding local meetings."

Professor Elliot has been elected Chairman of the Bristol Channel Centre.

Mr. Joseph Williams is expected to read his paper on the "Efficiency of Air Compressors," in the University College, Cardiff, on Wednesday, the 25th February.

TRIAL TRIPS OF THE SECOND-CLASS CRUISER "LATONA."

THE *Latona*, built and engined by the Barrow Naval Construction and Armaments Co., made her eight hours' natural draught trial on Friday, January 30th. She belongs to what is known as the *Apollo* type of second-class protected cruisers, of which there are no fewer than 17 being constructed by private firms, and two in the Royal dockyards under the Naval Defence Act, and five others under the usual service. As the *Latona* is the first of her numerous class, it is intended to submit the vessel, in addition to the contractors' runs, to a series of progressive trials on the measured mile, with the object of determining (for the benefit of the sister ships) her efficiency in respect of power and speed, and with special reference to the form of her propeller. The trial, which had been deferred from the previous day in consequence of the boisterous weather, proved more than usually successful. The first hour gave a collective power of 7,300 horses, the mean of the entire trial amounting to 7,247, or considerably beyond the contract. The revolutions were 136, the vacuum 28 in. and 27½ in. respectively, the average power developed by the starboard engine 3,602 and the port 3,605, the mean air pressure ·44 in., and the boiler pressure 153 lbs. The mean speed of four runs on the measured mile was also satisfactory, being 19·05 knots.

On February 6th the forced draught trial of the *Latona* was brought to a premature conclusion at Portsmouth, in consequence of a singular misadventure. An early start was made, Admiral Morant and the Engineer-in-Chief of the Navy being present, and just as the engines had been worked up to the requisite number of revolutions to secure the contract power, the forward mess-deck suddenly became flooded. The engines were stopped, and it was found that the fastenings of the outer flaps covering the hawse-holes had become loosened, and that the inner flaps had been forced open under the enormous pressure of the bow-wave. The water was bailed out and the inside plugs caulked, and when all was considered right the engines were again started. About an hour afterwards, when the vessel was rushing through the water at a speed of 19 or 20 knots, the plugs were again forced out by the outside pressure, and tons of water, estimated at 300, poured through the hawse-holes and filled the three foremost compartments of the ship before the engines could be stopped. The trim of the *Latona* at starting was 15 ft. 6 in. forward and 17 ft. 5 in. aft, but it was now ascertained that her draught forward was 17 ft. and aft 16 ft. 8 in. In other words, while she had gone down at the stem by 18 in. the propellers had been raised 9 in. The mess-deck presented a sorry sight, as the men's hammocks and mess traps were floating. It took some time before the water could drain to where the pumps could reach it, but after the forward immersion had been reduced, iron ballast was dragged aft to counterbalance the difference, and when, about noon, another start was made to complete the trial, the forward draught was 16 ft. 6 in. and the after draught 17 ft. It was now found that the deeper immersion brought the torpedo port in the stem so much lower down that, as soon as a high speed was attained, it threw up such piles of water that the hawse-flaps again opened, and the ship returned to harbour to have permanent alterations made. The engines worked admirably.

Although it has not been deemed expedient of late to test new vessels under forced draught, but to accept them from the contractors on their fulfilling the stipulated guarantee with natural draught, the second-class cruiser *Latona* was tried on February 10th at Portsmouth for four hours under the former conditions with satisfactory results. The ordeal was rendered practicable from the fact that not only have the boilers been increased in size relatively to the power to be developed by the engines, but, with a view of lessening the risk of leaky tubes and of localizing any defect which might arise therefrom, each furnace in the three double-ended boilers has been made with its combustion chamber separate and distinct from the others, the rectangular position between the ends of the boilers forming a water-chamber. The result is that, instead of the blast from the furnaces impinging upon the tube-plates, it is arrested by the sides of a water space, and utilized in producing steam. This type of boiler, we understand, is to be adopted in all the vessels built under the Naval Defence Act, whereby it will be possible not only to steam them at their maximum power, but without fear of the recurrence of such an accident as that on board the *Barracouta*. The Admiralty was represented by Mr. White, Director of Naval Construction, and Mr. Durston, engineer-in-chief, and the contractors (the Barrow Naval Construction and Armaments Co.) by Mr. Bryce-Douglas and Mr. Blechynden. The *Latona* left the dockyard at a quarter-past 9, and at 10 minutes to 10 (a marvellously brief interval) the engines had been sufficiently worked up to enable the trial to commence. The weather was very auspicious, there being neither fog nor wind nor sea. Since the flooding of her forward compartments during her former trial the hawse-holes had been effectually closed, and the hatches battened down; but, as a matter of fact, as the result proved, there was no occasion for these precautions. The bow wave itself had been abolished by the simple expedient of altering the trim of the ship (which was fully down to her designed load-line) without altering her mean draught. The mere reduction of 6 in. in her immersion forward made all the difference between flooding and comparatively smooth water under the bows. The mean pressure in the boiler, with an average air-force of 1½ in. amounted to 152 lbs. The vacuum was 26½ in., and the revolutions were 145, the two engines keeping excellent time throughout. The total I.H.P. of the starboard engine was 4,643, and of the port engine 4,795, giving a collective power of 9,438, the contract being for 9,000 The speed, as measured by the mean of four runs in the mile, was just over 20 knots, or practically equal to that of the quickest torpedo-boat. After the usual stopping and starting tests and trying of hand-steering gear, the ship returned into harbour. It is now certain that the *Latona* will realize the expectation of her designer, and will prove a valuable acquisition to the Navy.

LAUNCH OF THE S.S. "STATE OF CALIFORNIA."

THE steamer *State of California*, built for the State of California Steamship Co., Limited, Glasgow, was launched on January 29th, from the yard of Messrs Alexander Stephen & Sons at Linthouse in presence of a large concourse of spectators. The ceremony of naming the vessel was gracefully performed by Mrs. Mitchell, wife of ex-bailie Mitchell, the chairman of the Steamship State of California Co., Limited. The *State of California* is built of mild steel, and is classed 100 A1 in Lloyd's under special survey, with additional strengthening over Lloyd's requirements, and is built to comply with requirements of Admiralty for transport service. She is 400 ft. long over all, 46 ft. beam, and 32 ft. 8 in. moulded depth, and will have a gross register tonnage of about 4,500 tons, while the deadweight she is designed to carry on Lloyd's freeboard is 5,300 tons The vessel is divided into eight watertight compartments, the bulkheads of which are all carried to the upper deck, so as to ensure the greatest amount of safety in case of accident, and has also water-ballast tanks in cellular double bottom fore-and-aft, which can be filled or emptied expeditiously. The *State of California* is the first high-class passenger steamer added to the Glasgow and New York trade for a number of years, and she is designed to attain the highest speed possible, with capacity for sufficient cargo to ensure good earnings from freight even with few or no passengers, and thus be able to convey passengers at very moderate rates. She has sufficient engine power to ensure the greatest regularity by the maintenance of a good rate of speed in any weather. The vessel in her general arrangement resembles to some extent the type of vessel generally adopted for Atlantic passenger ships of late years, with the addition of a number of novel arrangements to specially suit the Glasgow trade. The saloon accommodation is situated all at the middle of the vessel, where there is least motion, and is capable of accommodating 260 passengers. The greater part of the state rooms are capable of being easily taken down if required, so as to suit a reduced number of passengers during the winter months, and the space can then be utilised either for cargo or fitted up for steerage passengers in the emigration season. From main deck the saloon accommodation is entered by doors on each side of the deckhouse, arranged with vestibules and inner vestibule doors, which admit into a spacious, well-lighted entrance hall, from which on the after side the grand staircase leads down to the main saloon and state rooms, and on the forward side a double staircase leads up to promenade deck, smoking-room, &c., while folding doors on each side lead into music and writing-room, which is situated immediately over main saloon. The saloon skylight is placed over music room on promenade deck, and lights both main saloon and the music-room. Saloon passengers by this arrangement have the best part of the vessel reserved entirely to themselves, and have access to all saloon accommodation without going on deck. The decoration of saloon and other public apartments is in polished hardwoods, and the different combinations are exceedingly chaste and effective. The music-room is pannelled in satin wood, birch and sycamore, and upholstered in Gobelin tapestry. The main saloon is in walnut and figured birch, with upholstery in Moquette. The ladies' cabin is in Tynecastle tapestry panelling and silk tapestry upholstery; and the smoking-room, staircases, and entrance hall are in different combinations of mahogany, oak, and walnut. The main saloon has tables running fore and aft, and small tables on each side placed athwartships, to suit parties travelling in company, families, &c. Revolving eccentric chairs are placed at all tables. The state rooms are all in white enamel, and upholstered in red velvet, the berths and sofas being fitted with spring mattresses, and the wash-basins are on the tipping principle in mahogany cases. Steerages are fitted for about 700 to 800 passengers forward and also aft of saloons on both the main and lower decks, and have very large entrances from deck to each, in which are placed the lavatories and other accommodation, so as to be easily reached without going on deck. The entire cabin and steerage accommodation is heated by steam, and also thoroughly ventilated, and the vessel throughout is fitted up with a double installation of electric light. The machinery consists of a set of triple-expansion engines of the latest design, having cylinders 34 in., 55 in., and 88 in., with a stroke of 54 in., supplied with steam by three steel boilers at 160 lbs. pressure. The surface condenser is of steel, and entirely separate from the engine framing, fitted with two sets of centrifugal pumps, each of which is capable of doing full duty, so that there is always a spare set. Three sets of Weir's automatic feed pumps are fitted, and also feed heater and evaporator. There are two air pumps and two bilge pumps driven by levers from the main engines, and also two large ballast and bilge pumps separately arranged to pump from all compartments of the vessel. The steam steering gear (by Muir & Caldwell) and also hand gear (by Napier Bros.) are both placed in the wheel-house under the after poop, with direct connection to rudder circle and crosshead. There are five cargo hatches and seven steam winches, and a steam windlass and capstan. The vessel has three polemasts, with yards on foremast only, and one oval funnel. The accommodation for officers and engineers is situated in deck-houses amidships, and crew forward under upper deck, and is all of the most ample and comfortable description, while the galleys, butcher's and baker's shops, &c., &c., are all adjoining each other in deck-house, round funnel, and have staircase communicating direct with saloon pantry below. The vessel has a very handsome appearance, and ought to take little water on deck, as there are bulwarks all round, and there is little doubt that the *State of California* when she is put on her station will fulfil the best expectations of all concerned, and be a favourite vessel with the travelling public. The new ship is expected to sail from Glasgow to New York on 3rd April, and will be under the command of Captain A. G. Braes, who has been long and favourably known in the Clyde trade as the commander of the *State of Nebraska* and commodore of the State Line. The vessel was constructed under the direction of Mr. George M'Farlane, marine superintendent to the company.

A STEERING SCREW PROPELLER.

THAT the screw propeller in ordinary use is capable of improvement is, of course, a hard fact, and any suggestion which will tend to remove its present disadvantages will always be welcome.

We have had brought under our notice a modification of the present arrangement which appears to offer sufficient features of interest to justify us in laying them before our readers.

Among the disadvantages attached to the ordinary screw propeller are the active resistance it offers to the manœuvring of the vessel and the consequent waste of power and loss of speed; the inequality of strain on the blades during such manœuvring, and the accompanying vibration and jarring.

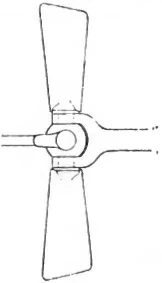


Fig. 1.

In the propeller now under consideration the shaft terminates in a universal joint which connects it with a smaller shaft, or, more properly speaking, an extension of itself. The centre—or connecting—piece of this joint is taken as the base from which the propeller blades spring, and to which they are rigidly fixed. In the case of a two-bladed screw, the blades are best attached to the centre-piece at those points where it is held by the two arms of the main shaft. Fig. 1 shows a sketch of this propeller, and is intended to illustrate the principle of the invention rather than its detail.

It seems clear that the pitches of the blades can be altered to any extent by changing the position of the shaft-extension, and that any increase in the pitch of one blade is accompanied by a corresponding decrease in that of the other. For the present purpose, however, the movements of the shaft-extension must be confined to the horizontal plane in which the main shaft lies. The methods of supporting this extension may be varied, but we will at present only describe one—that shown in Fig. 2. It will be seen that a vertical frame is supported at two points, one directly above, and the other directly beneath the centre of the joint. This frame is at liberty to swing horizontally from side to side at the rear of the screw. It carries the end of the extension in a circular bore cut in its central part.

In a horizontal plane the extension can thus move with the frame, and at the same time be at liberty to follow the rotary motion imparted to it by the main shaft. In order to give it stability in the water and enable it to act as a rudder when the screw is not working, the rear part of this supporting frame is made deep from front to back, and is manipulated from deck in the same way as an ordinary rudder.

This coupling of the extension-supporting frame and the rudder, this as it were Siamese twins arrangement, seems to offer some considerations worthy of study. The manœuvring power of the vessel seems to be greatly increased, its stability in its course is not affected, the shaft extension and therefore the "feathering" being under complete control, while no power is lost or wasted, as the "feathering" equalizes the strain upon the blades and thus enables the screw to do its full work.

When we come to consider this matter of the "feathering" of the blades, we find that when the vessel is turning, the propeller is, of course, passing obliquely through the water. This is tantamount to saying that the water meets the screw obliquely; and the illustration (Fig. 3) shows that under these conditions the "feathering" of the blades is practically automatic. In this horizontal plan the vessel is supposed to be turning to the right and the blades to be in a vertical position. Suppose also that the extension is entirely removed from the propeller. Let E F represent the main shaft, A B the upper blade, C D the lower blade, and the arrows the direction in which the water meets the propeller. Then it is clear that the blades would have a tendency to arrange themselves so that the angle which the arrows make with each blade should be the same. They would therefore, when vertical, be in the position here shown. Similarly, when the blades are horizontal, they have a tendency to become of equal pitch, for the direction in which the water meets the screw is in the same horizontal plane with the blades. Its obliquity *in* that plane has no influence on the "feathering."

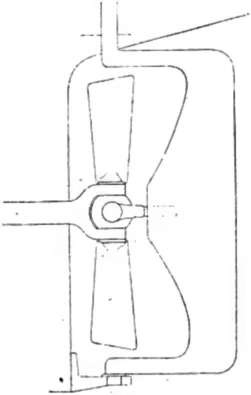


FIG. 2.

Now the two positions which have just been shown to be natural to the blades when the vessel is turning to the right are identical with those which the extension, if moved to the right, would impart to them; and in the same way it can be shown that in moving from the horizontal to the vertical position, and *vice versa*, the blades would naturally vary in pitch in the same manner and degree as when guided by the extension. This "feathering" therefore becomes automatic after the first momentary effort necessary to produce a change in the course of the vessel. The same can be shown to be the case when the vessel is turning to the left, and the demonstration is equally applicable, whether the vessel be going ahead or astern.

In the four-bladed propeller the blades are fixed to the centre-piece of the joint at its four bearing-points. Two of its blades therefore occupy the same positions as those of the propeller shown in Fig. 1, and revolve in a plane at right angles to the main-shaft. The two additional blades, however, revolve in a plane which is always at right angles to the shaft-extension, and in that plane they "feather" with the same effect as the two original blades. For if the shaft-extension be moved to the right, the pitch of the upper of the two additional blades is reduced, and that of the lower increased, the moment of greatest variation being when the blades are vertical. (These variations in pitch must, of course, be considered relatively to the plane in which the blades are working.) When the two blades are horizontal the pitch of one is equal to that of the other. It is thus seen that these two blades tend to change the direction of the vessel to the right, and that the steering effect is greatest when they are in a horizontal position. A similar effect is, however, produced by the two original blades when in a vertical position. The four blades are, therefore, at any moment working in harmony and with precisely similar effects. This may also be shown to be the case when the extension is moved to the left, and when the vessel is going astern. In a three-bladed screw, one blade may be in the same position as either of those in Fig. 1. The two others are then fixed to the centre-piece of the joint at equal intervals from one another, and from the first, the base-centres of all three being in the plane which passes through the four bearing points of the joint, so that when the extension is in the same straight line with the main-shaft, the plane of revolution of the blades is perpendicular to that straight line. The steering effect of the first blade is due to its "feathering," and that of the two others to a motion derived partly from "feathering" and partly from the inclined position of the plane of revolution; and it will be found that the three blades work in concert similarly to those of the four-bladed propeller.

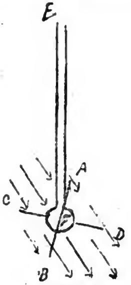


Fig 3

With this method of steering it should be stated that there is no vibration in turning, and no speed lost, as is the case where the rudder alone is used for steering. Again, as no power is transmitted through the joint, it is subjected to no strain, and is therefore not liable to get out of order, while the "feathering" being, as we have said, all but automatic there can be little strain on the extension. The mechanism and working of the propeller being simple and natural, and no part being subjected to any undue strain, the wear and tear is therefore reduced to a minimum. Lastly, the blades being rigidly fixed to the centre-piece of the joint, and

Google

therefore to one another, are as firmly and strongly based as in the ordinary screw-propeller. It should be mentioned that although many different forms of joint may be used, they each and all must embody the principle of Hooke's Universal Joint.

Two other methods of connecting the rudder and the shaft extension other than we have described, have, we believe, been designed. In one, the ordinary rudder has been detained in its place behind the propeller, the extension-support (but not so deep from front to back, as shown in Fig. 2), and the rudder being linked together on deck. In the other plan, the ordinary rudder is discarded, but the extension-support, acting as a rudder, swings about a vertical line *behind* the centre of the joint, and so carries the extension through a smaller angle than that through which it moves itself.

To all craft requiring to navigate crowded or intricate waterways, the propeller we have described should offer many advantages. It seems to differ in some essential points from every other designed with the same object in view, not the least important of which lies in its simplicity.

The credit of the invention is due to Mr. F. H. White, of No. 6, Rylett Road, Shepherd's Bush, London.

TRIAL TRIP OF THE S.S. "OTTAWA."

THE *Ottawa* is a spar-deck screw steamer of highest class in Lloyd's, and built by Messrs. Alex. Stephen & Sons, Linthouse, Glasgow, for Mr. C. Furness, M.P., of West Hartlepool, London, &c., in the old country, and of Boston, Baltimore, &c., in the new. She is specially designed for the trade between London and Nova Scotia, Newfoundland, &c., in which his steamers *Damara* and *Ulunda*, by the same builders, have for some years been so popular and successful.

The *Ottawa* is built of mild steel, and in addition to the requirements for her class in Lloyd's, has all the special provisions and improvements which experience could suggest to make her as perfect a vessel as it is possible to construct for the service intended. Her dimensions are:—Length, over all, 285 ft.; breadth, extreme, 35 ft; depth, moulded, 24 ft. The 'tween decks are high and airy, and the hold spaces are not broken up by beams—the construction being on the deep frame principle. The passenger accommodation is all in the best part of the ship—the saloon, ladies' cabin, captain's room, and state rooms being placed in the bridge-house; and the smoking-room in house on top of bridge-house, communicating with companion way to saloon, &c. The saloon is handsomely fitted up and has a very pleasing effect. The walls are panelled in walnut, amboyna, and satinwood, with decorations in terra-cotta tapestry, and the ceiling panelled in wood relieved with gold. The cushions, curtains, &c., are of superior qualities of material in rich and harmonious colourings. The state room accommodation is for about thirty-three first-class passengers, and is replete with every comfort and convenience. The beautiful system of electric light fitted throughout the entire ship adds greatly to the charm of saloon, state rooms, &c., and will also contribute much to the pleasure and comfort of all on board. The officers' and engineers' rooms are in bridge-house, alongside engine casing, and the crew are located below spar-deck forward. The other deck erections include turtle-backs forward and aft in excellent harmony with the general design; flying bridge carrying steam and hand-steering gear, &c. The vessel is schooner-rigged, the model is remarkably graceful, and altogether the ship has an exceptionally fine appearance. Provision is made for the most expeditious and effective working of the ship and cargo; and for carrying water-ballast when desired, in cellular double-bottom extending all fore and aft, but divided, for purposes of trim, into compartments having separate connections to powerful steam pumps. The main engines, also designed and constructed by the Messrs. Stephen, are of triple-expansion type, and have cylinders, 22 in., 35 in., and 58 in., diam. by 42 in. stroke, fed with steam from two large boilers suitable for a working pressure of 160 lbs., and fitted with Purves' patent-ribbed flues. A large vertical donkey boiler supplies steam for winches, &c.

The trial trip took place in Firth of Clyde in stormy weather on Monday, 2nd February. The engines worked splendidly, and with remarkable smoothness; and a mean speed of 12¼ knots was maintained. The *Ottawa* will, no doubt, prove a very successful boat, and a still greater favourite on the route than the previous vessels of the "Furness" Line.

H.M.S. "ASSAYE."

THE above torpedo gunboat was launched from the Elswick yard, on Wednesday, February 11th. Her dimensions are as follows:—Length, 230 ft.; breadth, 27 ft.; mean draft, 8¼ ft.; displacement, 740 tons; I.H.P. (forced draught) 4,500; speed, 21 knots. Her armament will consist of two 12-in. centimeter rapid firing guns, four 3-pounder rapid firing guns, and five torpedo launching tubes, one fixed in the stem, and four training tubes mounted in pairs on the upper deck. One hundred tons of coal will enable the boat to steam a distance of about 3,000 knots at 10 knots speed. She will carry 93 officers and men. There was a large company present, including Major and Mrs. Martin, Col. Dyer, Mr. J. M. Falkner, Mr. Black, Mr. and Mrs. Arkwright, &c., &c.

As the vessel left the stays she was gracefully named the *Assaye* by Mrs. Martin. The company then adjourned to the model room, where Col. Dyer proposed success and prosperity to the vessel, and in doing so remarked that her armament, although not large, was exceedingly powerful. She could fire 10 rounds per minute from her quick firing guns and a torpedo boat would stand little chance against her. Her name was happily chosen, commemorating as it did one of our brilliant victories which had given India to this country, and further added that he did not doubt if this vessel was called upon to strike a blow in anger she would give a good account of herself. Mr. Dean proposed the health of Mrs. Martin, which was drunk with great enthusiasm. Major Martin, C.B., responded on behalf of his wife, and remarked that he perceived no less than nine vessels being built at the present moment, they formed quite a navy of themselves, and of all people Elswick and its staff were second to none in having made England the great power that it is. In conclusion, he hoped that the Indian Government would send many more orders to Elswick and that they would see the slips full for many a long day.

THE ITALIAN SHIPPING TRADE.

ACCORDING to the statistics for 1889, just published, both the international and coasting trade of the principal ports of Italy is decidedly increasing. Excluding the fishing industry the number of all categories of ships which entered and left Italian ports during the year 1889, aggregated 232,549 vessels, and 41,670,976 tons. These figures are by 10,389 ships and 1,537,409 tons in excess of the preceding year. The general results are thus given:—

	Steamers.		Sailing Vessels.	
	Number.	Tonnage.	Number.	Tonnage.
International ..	12,706	12,206,208	18,773	1,665,496
Coasting ..	47,362	22,498,694	153,708	5,300,578
Together ..	60,068	34,704,902	172,481	6,966,074

Compared with 1888, the international steamer tonnage showed an increase of 829,101 tons, and the coasting a progress of 607,358 tons, whereas the sailing vessels for the international trade exhibited a decrease of 27,650 tons, but an augmentation of 128,600 tons in the coasting business. Still more interesting is the table of goods discharged and received during a longer period of years, as it demonstrates more clearly the ever-growing volume of shipping transactions in the Italian ports:—

Goods Received or Discharged.

Year.	Steamers.	Sailing Vessels.	Together (Tons).
1881	4,531,067	5,059,866	9,590,933
1882	4,845,643	4,833,792	9,679,435
1883	5,915,526	4,713,501	10,629,027
1884	5,884,847	4,435,055	10,319,902
1885	7,002,847	4,968,255	11,971,102
1886	7,230,276	4,768,369	11,998,645
1887	9,049,052	4,787,103	13,836,155
1888	8,681,453	4,705,454	13,386,907
1889	9,735,599	4,800,502	14,536,101

Divided into international and coasting trade these figures show:—

	International Shipping.		Coasting Trade.	
Year.	Steamers.	Sailing Vessels.	Steamers.	Sailing Vessels. Tons.
1881	2,670,195	2,137,983	1,860,872	2,921,883
1885	4,525,200	1,878,462	2,477,647	2,787,490
1887	6,141,759	1,663,192	2,907,293	3,123,911
1888	5,318,831	1,335,876	3,362,622	3,369,578
1889	6,616,571	1,404,519	3,119,028	3,395,983

Thus, the international shipping represented in 1889, a total of 8,021,090, and the coasting trade 6,515,011 tons, the former having improved to the extent of 20½ per cent. compared with 1888, and exceeding even by 3 per cent. the tonnage of 1887, though the latter year was exceptionally active on account of the then impending abandonment of the commercial relations with France. The aggregate movement of tonnage was in 1889 absolutely the largest on record, and though the coasting trade lost 217,189 tons against 1888, it gained 483,807 tons over 1887. The following statement exhibits the share of each of the principal ports in the tonnage of 1889:—

	Arrivals.			Departures.		
	Ships.	Tonnage.	Goods discharged. Tons.	Ships.	Tonnage.	Goods received. Tons.
Ancona	1,057	436,272	252,988	1,033	432,008	18,291
Bari	1,066	454,355	87,299	1,071	415,104	64,611
Brindisi	1,136	1,168,426	195,255	1,132	1,164,868	49,432
Cagliari	1,427	383,966	93,248	1,437	383,966	174,679
Cotane	2,944	856,575	141,973	2,956	858,084	216,294
Genoa	7,512	3,267,131	2,915,879	7,199	3,215,877	1,192,974
Leghorn	3,754	1,274,895	542,126	2,885	1,089,920	237,761
Naples	2,886	1,092,478	229,117	2,675	1,119,517	128,306
Palermo	2,978	951,456	330,743	2,201	844,261	230,736
Savona	1,273	501,163	720,520	1,279	508,224	42,119
Venice	2,934	918,720	857,343	1,408	578,314	162,560

Genoa is by far the most important harbour. Its arrivals comprised 3,640 sailing vessels of 334,051 tonnage, discharging 440,518 tons of goods, besides 853 sailing ships in ballast (40,347 tons) and 2,767 steamers of 2,696,701 tons, discharging 2,475,361 tons of merchandise, as well as 252 steamers in ballast (196,032 tons). The departures included 1,758 sailing vessels (125,930 tons) carrying 129,097 tons of freight; further, 2,457 sailing ships (217,553 tons) in ballast, 2,001 steamers (1,853,003 tons) with 1,063,877 tons of goods, and lastly, 983 steamers (1,019,391 tons) in ballast. The remarkable development of the Genoa traffic is due to the increased facilities provided in the port, and also to the many railways. The growth was only once interrupted since 1882, viz., in 1888, but the following year brought instead an increase of 400 arrivals and departures of 816,000 tonnage, and over a million tons of goods. The traffic by sea alone doubled since 1882, as far as merchandize is concerned. Nevertheless, the foremost foreign trade is done by Venice. Against the 1,958 sailing vessels and 976 steamers, respectively 116,757 and 801,963 tons, arrivals, there were departures—724 sailing ships (48,324 tons) and 684 steamers (529,000 tons). The movement of merchandise, as given above, was, moreover, in excess of any preceding year since 1883. As to the other ports, Ancona and Brindisi had a larger exchange of goods and coasting traffic than in 1888, Cagliari and Leghorn did a more extensive international business, whereas Cotane, Messina and Naples increased their coasting traffic. The overwhelming share of the whole shipping fell, of course, to the English flag. Italy ranks next, and is followed by Austria and France, both of which countries participated to some considerable extent, whereas Germany and the United States were interested with merely a small percentage. The details are:—

I.—International Shipping.

Nationality.	Steamers. Number.	Steamers. Tonnage of Goods.	Sailing Vessels. Number.	Sailing Vessels. Tonnage of Goods.
English ..	5,675	4,736,604	551	51,976
Italian ..	2,996	661,522	14,523	948,612
Austrian ..	1,321	193,068	1,434	87,733
French ..	1,261	245,750	200	8,080
German ..	729	245,105	5	660
Greek	281	124,389	1,423	215,846
American ..	8	2,731	9	5,562
Sundries ..	735	407,402	628	86,050
Total	12,706	6,616,571	18,773	1,404,519

II.—Coasting.

Nationality.	Steamers. Number.	Steamers. Tonnage of Goods.	Sailing Vessels. Number.	Sailing Vessels. Tonnage of Goods.
English ..	3,141	720,922	98	2,967
Italian ..	42,845	2,096,312	153,123	3,255,054
Austrian ..	117	21,830	134	9,843
French ..	12	790	3	90
German ..	449	97,500	13	977
Greek	66	29,304	199	21,132
American ..	2	723	4	390
Sundries ..	730	142,738	134	5,530
Total	47,362	3,119,028	153,708	3,595,983

England secured, therefore, about 70 per cent. of the international steam shipping, and 59 per cent. of the shipping of the steamers and sailing vessels combined. Though the carriage of merchandise between the various Italian ports is principally undertaken by small Italian crafts, English vessels secured even 11 per cent. of that class of traffic, whereas all other nations (except Italy) participated in the same to the extent of together 5 per cent. The progress of Italian shipping is at the same time very noteworthy. Not only is 20 per cent. of the international movement of merchandise conducted under the Italian flag, but the principal part of the coasting shipping, viz , 83 per cent., is done by Italian vessels. In this particular branch the increase since 1881 represents 18 per cent. for the traffic in sailing vessels, and 100 per cent. in the case of steam navigation.

THE NEW YACHT, "THE PRINCESS ALICE."

On February 12th a new yacht, which has been specially designed and built for the Prince of Monaco by Messrs. R. and H. Green, was launched from their yard at Blackwall. The vessel was named *The Princess Alice*, after the Princess of Monaco. It is designed and fitted for making researches in the deep sea, and is capable of keeping the sea in all weathers. The yacht is a steel composite, 3-masted, square foretopsail schooner, with auxiliary steam power. The framework is of steel, whilst the shell is of teak planking, fastened with yellow metal bolts. This is found to be the best form of construction for a steam and sailing yacht for cruising purposes.

The following are the principal dimensions of the yacht:—Length on load water-line, 168 ft.; length between perpendiculars, 170 ft.; beam, extreme, 27 ft.; depth, moulded at centre, 16 ft. 9 in.; depth, moulded at side, 16 ft. 3 in.; draught, mean, 12 ft. 9 in.; tonnage, Thames yacht measurement, 555 tons.

The yacht is to be fitted up with a triple-expansion surface-condensing single-screw engine, by Messrs. John Penn & Sons, of Greenwich. The engine is to be of 350 I.H.P., and is to ensure a speed of nine knots. The gun-metal propeller is made on Bevis's principle, with two blades only, so as not to interfere with the sailing qualities of the vessel. Two boilers are to be fitted, one of which will be used for the purpose of electric lighting. There is also to be a machine for the supply of cold air, and a condenser for the supply of fresh water, although this will be but little used, as there is accommodation for 25 tons of fresh water in tanks. Two Downton pumps are to be provided.

The deckhouse and the main and lower decks are built of teak, and so also are the stern posts and rudder. The stem is of oak, and the keel and false keel are of English elm. The lower masts and bowsprit are to be of Oregon pine, and the topmasts and spars of Norway pine. The hull is sheathed with pure copper. All the steel fittings are to be galvanised to avoid rust. Four boats and a steam launch are to be carried on board the vessel, and sufficient space is provided in the bunker for 80 tons of coal.

From a view of the plans of the vessel, it appears that forward on the main deck, in place of the usual windlass, a steam anchor capstan will be fitted, and on either side of the foremast will be the steam winch and steam winding drum for the dredging apparatus. These machines are to be supplied by M. Le Blanc, the Paris engineer, who has always furnished the Prince of Monaco with the apparatus used in his researches.

The ship is to be divided into watertight compartments, any two of which may be filled with water without imperilling the safety of the vessel. With regard to the sailing powers of the vessel, she is expected to be one of the best cruising yachts yet built, and to be a fast sailer. Messrs. Ratsey & Lapthorn have been commissioned to provide the sails, which are to have a spread of 12,000 ft.

The arrangements made for the accommodation of the prince, his scientific staff, and the crew are, we understand, to be elaborate. The prince's deck cabin in the fore part of the deckhouse is to be so made as to allow a complete view of the horizon to be taken from a glass look-out tower. For the prince's use in his scientific researches there are to be laboratories, an aquarium, and a dark room for photographic purposes. The dining saloon, which is to seat 12 persons, measures 16 ft. by 9 ft. The room is to communicate by swing doors with the main saloon, measuring 26 ft. by 15 ft. The prince's private set of cabins, which are to be on the starboard side, will consist of a studio, a sitting-room, and a bedroom fitted with a bath in the floor. There are to be cabins set apart for the prince's immediate attendants and for those assisting in his scientific operations. The forecastle, measuring 22 ft. in length, is designed to contain bunks for 16 men, and is fitted with a bath, and abaft of this will be the cabins of the officers of the vessel.

MERRYWEATHER'S WATER-TUBE LAUNCH BOILER.

NOW that the season is at hand when steam launches will be overhauled preparatory to being put into active service, we cannot do better than lay before our yachting friends a brief description of a water-tube boiler, which, although not altogether new in its construction, has been now so modified as to meet their requirements in supplying them with a compact, handy, and quick steam-raising boiler.

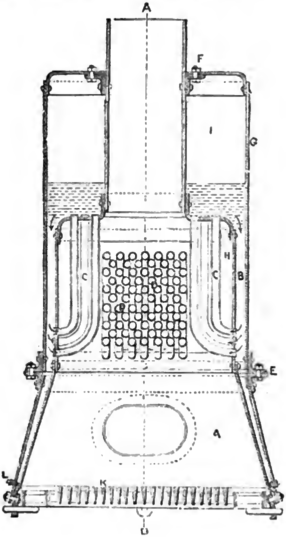


Fig. 1.

Our illustrations show two sections of it. Fig. 1 is a vertical section, and Fig. 2 is a vertical section taken at right angles to Fig. 1. D D are inclined water tubes open at both ends to the water space B. C C are curved water-tubes forming a communication between the upper part of the boiler I and the water space B. Ample space is arranged above the fire-grate K for the free combustion of the fuel, and, owing to the arrangement of the tubes, the ignited gases burn freely in the combustion chamber H, thus utilising to the utmost the fuel consumed. A perfect circulation of water is obtained by means of the tubes, and the steam is freely disengaged from the upper ends of the tubes D and C C over a large area of water surface, thus obviating any tendency to prime, through the ascending currents of steam disturbing the water. All sediment from the water evaporated collects at the bottom of the water space B, and is readily removed from the wash-out holes L L, while, by unbolting the joints E and F, free access is obtained to the whole interior of the boiler. The whole of the boiler is made of Lowmoor iron, with welded seams, and the tubes are of solid-drawn steel.

Its chief advantages lie in the little space it occupies, its comparatively light weight, yet so strongly constructed as to be perfectly safe, and its quick steam-raising power. We are informed that with it, steam can be raised in three minutes, and in something under ten minutes, to 100 lbs. on the square inch, and this pressure can be maintained with great ease and economy of fuel.

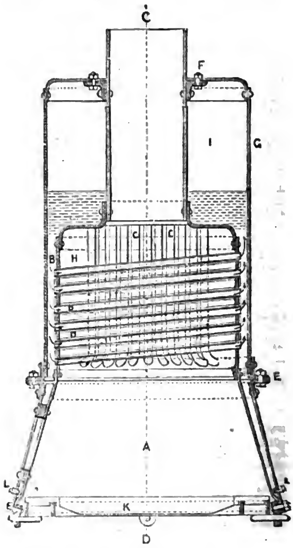


Fig. 2.

Boilers of this class, of 100 H.P., have recently been constructed by Messrs. Merryweather for the Spanish Government, for use on their war-ships, as auxiliary boilers to supply steam to fire pumps, circulating pumps, and bilge pumps; and are placed above the water-line, so that they may be available if the fires in the main boilers are extinguished.

It will be observed from the illustrations that the boiler is fitted with a water-casing surrounding the fire-box, thereby obviating almost entirely the risk of woodwork near it catching fire, and at the same time contributing considerably to the coolness of the vessel in which they are fitted, a matter of considerable importance in the case of small launches. As we have pointed out, ready access to the interior of the boiler is afforded by means of the bolted joint for cleaning purposes, but this will be seldom required. On account of the rapid circulation of water, no sediment or dirt accumulates in the tubes, and owing to their position, as well as the method of securing them, unequal expansion and contraction is avoided, the tubes remaining perfectly tight under all circumstances.

Admiral Gordon, of Eastbourne, has, we believe, had one of these boilers in use in his yacht for some years. It was modified by his instructions to suit the requirements of his vessel, and among other alterations he has had brass tubes fitted in place of steel, and we understand that in its modified form the whole of the boiler is now, after six years' service, in a most satisfactory state, showing no signs of decay, and working up to 120 lbs. per square inch, with nothing but salt water used.

Messrs. Merryweather & Sons, of Greenwich and Long Acre, London, are the patentees and makers, and they will, no doubt, on being consulted, be ready to supply boilers of this construction to suit all classes of steam yachts and launches.

IMPROVEMENTS IN ENGINE PRACTICE.

A MEETING of the Institute was held on Tuesday, 10th February, in the Langthorne Rooms, Stratford, when Mr. W. W. Wilson read a paper on "Improvements in Engine-room Practice." The meeting was presided over by Mr. J. McF. Gray.

Mr. Wilson explained that in consequence of the paper on the "Application of Zinc" not being available for this evening in consequence of the indisposition of the author, he had volunteered to read a few notes he had prepared on the subject of improvements in engine-room practice, which, though not put in the form of a well prepared paper, would doubtless be found useful for discussion purposes. The first detail of the engine referred to was pistons, the different styles of which were referred to, and the adoption of the Ramsbottom rings was considered to be a very great improvement. The valves, eccentrics, shafting, thrust, boiler mountings, and safety valves were mentioned, and the difference between the old systems and the new pointed out. The Chairman commented upon the excellent paper which had been read and the many valuable hints which had been given by Mr. Wilson, and called upon members to verify or controvert the remarks made in the course of the paper.

The discussion was maintained by Messrs. J. R. Ruthven, Kirkwood, Anderson, J. Y. Lowe, C. Noble, the Hon. Secretary, the Chairman, and others, in the course of which some interesting experiences were related.

The series of questions recently propounded by the Admiralty Engineer to the engineers of the Mercantile Marine regarding the practice in connection with the working of boilers and the feed-water arrangements, were given for discussion, and it was stated, in reply to the first question, that boilers had been run for about five months with the same water or without emptying them; the other questions were also dealt with to the effect that in the most recent types of machinery provision was made for supplying the loss of fresh water by means of evaporators, tanks built in the engine-room or stoke-holds, purchasing fresh water at places of call, or supplementing by means of the donkey boiler; that the supply of steam to baths, sculleries, pantries, and leakages were the chief sources of loss of fresh water, and that these amounted to from three tons per day. It was pointed out that the practice of fitting a hot-water tank with a supply pipe from the circulating discharge water and superheating it by means of a coil was coming more into use, thus doing away with the loss of fresh water entirely for baths, &c.

The meeting closed with votes of thanks awarded to the author of the paper and the chairman, moved and seconded by Messrs. Kirkwood and Turnbull, and by Messrs. Balloch and Lowe, respectively.

It was announced that the annual meeting would take place on the first Friday in April, before which time the voting papers for the election of office bearers for the new session should be forwarded to the Hon. Secretary.

LIQUID FUEL.

AT the Cannon Street Hotel on Friday night, February 13th, before a meeting of the Shipmasters' Society, Captain Holt in the chair, a paper was read on "Liquid Fuel in Ocean Steamers" by Captain W. V. Carmichael. Premising that the question of liquid fuel in steamers was not a new one, the lecturer stated that, partly owing to the cheapness of coal, and partly to the timidity of owners to adopt it, the use of oil fuel had not been much taken up by steamship owners. Now, however, the aspect of affairs was changing. By the use of petroleum he stated that the fires were completely under the control of the engineer on watch, who would regulate them so as to have any pressure of steam he required, without being dependent on his firemen. The great advantage of oil fuel to the shipowner was that he could carry his fuel in a space that was now wasted—namely, a cellular bottom of the ship, or in ballast tanks. As the consumption of oil, compared with coal, was, weight for weight, one-half—ten tons of coal, in other words, being only equal to five of oil—the storage of fuel could be made much more compact and easier of access; there was increased speed in fuelling the ship; and port charges were avoided, as more fuel could be carried in proportion than formerly. Petroleum was known to exist in all parts of the habitable globe, and it was hardly probable that competition would not bring the fuel within easy reach of the commercial world. For many reasons oil fuel was of more value to torpedo boats and ships of war than it probably was to merchant steamers. As to the question of fuelling our men-of-war at sea during a blockade, he thought that the large tank steamers of the present day could always fuel the fleet, even in heavy weather. He maintained that the oil was perfectly safe while on board ship; that it could be stored on shore easily, and in the event of a fuelling port being bombarded shells could not set fire to the tanks; and it could be handled without risk of fire or explosion from the shore to the ships, or *vice versa*. His object in reading the paper had been to allow the mercantile world in general, and the members of the Shipmasters' Society particularly, to know the progress oil fuel was making; the comfort it was to engineers and all concerned; its pecuniary advantages to the merchant who could avail himself of it; its peculiar adaptability to ships of war; and its special value to large, first-class passenger steamers, where cleanliness and the comfort of the passenger were desired. It could be adopted to any boiler, either afloat or ashore. A discussion followed.

ALUMINIUM BRONZE.—Cowle's aluminium bronze continues to make headway, and as the price is now slightly below manganese bronze, there is little doubt that it will supplant that material for screw propellers in high-speed vessels. It is also being most extensively used for crucial engineering and hydraulic purposes, and for the firing tubes of gas engines is rapidly becoming the material for this specific purpose.

STEAMER FOR THE CONGO.

MESSRS. JOHN I. THORNYCROFT & Co., of Chiswick, have been entrusted by the Baptist Missionary Society with the order for a new steamer for mission work on the Congo. The vessel will be of the same type as the *Peace*, which was built for the society by the same firm in 1882. This boat was recently forcibly requisitioned by the Congo Free State, she being the only craft on the river which had a sufficiently light draught (1 ft.) for their purpose.

To avoid the possibility of being again placed in the unpleasant predicament of being without a vessel with which to maintain communication with their brethren at distant stations, the society propose to place another steamer at Stanley Pool, but before deciding upon the design they wished to make a careful study of the question of the best type of vessel for the work, and for this purpose invited tenders from a number of the most noted builders of stern-wheel and side-wheel boats.

After due consideration they have decided that there were advantages in Messrs. Thornycroft's twin-screw turbine system which could not be obtained with any other. The weight of machinery is very small as compared with paddle engines of the same power, an important consideration when the cost of overland transport is so serious. The change of draught of water when light and laden makes the screw a more suitable propeller for a cargo-carrying vessel than side wheels, and as compared with a stern-wheeler, and the machinery being in the middle of the boat, the hull is less strained than when the boiler and engines are at the extremities, and does not require to be artificially supported by kingposts and tie-rods. The able missionary, Mr. George Grenfell, who drew up the specification, and who will superintend the building of the vessel, lays great stress upon a special feature in the design, which is that from his position on the upper deck, close to the wheel, he can himself manipulate the steam valve and handle the reversing levers, having at the same time under his eye the steersman, engineer, and fireman.

The new vessel will be 84 ft. long and 13 ft. beam, and will draw 2 ft. 2 in. when laden with cargo. She is therefore considerably larger than the *Peace*, which little vessel was not designed to carry anything besides four persons and the necessary fuel and stores. It was not to be wondered at, therefore, that she failed to satisfy Mr. Stanley's requirements as to speed when she was loaded with 135 people, an emergency in which she hardly deserved the contumely heaped upon her. The new boat will have the Thornycroft water tube boiler, a type which was originally adopted for the *Peace* on account of its portability. It may be of interest to say that this boiler was completely put together by mission boys, and steam raised the third day after re-erection was begun. It worked for six years on the steamer, and is now driving a saw-mill at the station, and the testimony of Mr. Grenfell is that the steamer hands all wish it was on board the *Peace* again instead of in the workshop, as the new vertical boiler which replaced it is already giving trouble.

LAUNCH OF THE SECOND-CLASS CRUISER "APOLLO."

ON February 10th the second-class cruiser *Apollo* was successfully launched at Chatham Dockyard in the presence of a company which included the Earl and Countess of Glasgow, the Countess of Darnley and Lady Blythe, Vice-Admiral C. F. Curme, Commander-in-Chief at the Nore, Rear-Admiral E. Kelly, Superintendent at Chatham Dockyard, Major-General W. H. Goodenough, C.B., and Major-General R. N. Dawson Scott. Owing to the tide not being sufficiently high, the vessel did not leave the slips until several minutes after the time originally fixed. The chaplain of the dockyard (Rev. J. B. Budds) having read the service used on such occasions, the Countess of Glasgow broke a bottle of wine upon the end of the vessel, and then severed the cord which released the dogshores, and the vessel gracefully glided into the waters of the Medway. The *Apollo*, which is sister ship to the *Andromache*, built at the same yard, should have been launched last September, but delays have been caused through the non-deliv [illegible] the machinery. As she is of a class to protect our [illegible] will be powerfully engined. With forced [illegible] expected to steam at the rate of 20 knots, and [illegible] draught 18 knots will be obtained. Her armament will consist of two 6 in. breach-loading central pivot guns, six quick-firing 4·7 in. central pivot guns, and also one 3-pounder Hotchkiss, and four five-barrel Nordenfeldts. In addition there are four tubes for the discharge of torpedoes. The *Apollo* was laid down on the 27th of May, 1889, and is now in such an advanced state that it will be but a short time before she is ready for sea.

THE ROYAL NAVAL EXHIBITION, 1891.

GREAT progress has been made during the past month in the erection of the various buildings, &c., which will eventually be comprised in this exhibition.

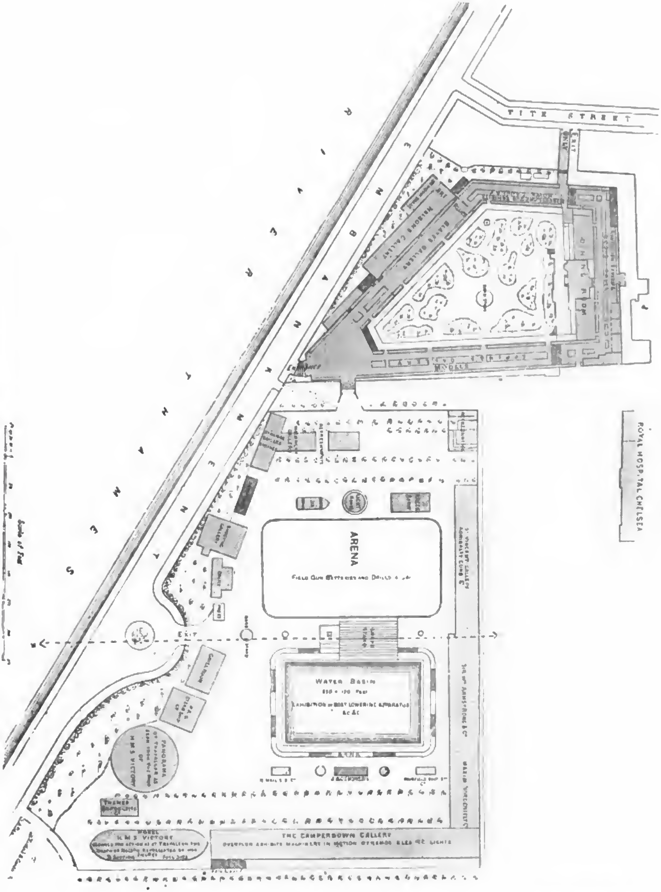
We present our readers this month with a plan of the grounds and buildings as they will appear when completed. From this it will be seen that ample provision has been made in all departments for holding a successful display. In addition to the exhibitors mentioned in previous notices, we learn that the firm of Messrs. Latimer, Clark & Muirhead, in conjunction with Messrs. Belliss & Co., of Birmingham, are to exhibit search lights, and that Messrs. Fowler & Co., Leeds, are going to send one of their portable railways for the grounds of the exhibition, in order to assist the Executive in the installation of the weighty exhibits, such as guns, plates, forgings, &c., which will no doubt prove of great service. Messrs. N. Hingley & Co., Dudley, are to have an exhibition of their well-known anchors; and Messrs. Ronald Scott, and Siemens Bros. & Co. are, in addition to those firms already mentioned, likewise to exhibit search lights.

On our visit to the grounds we found the general arrangements very far advanced, and should similar progress be made in the next few weeks, these will be completed in ample time for allowing the exhibits to be placed in their proper positions, and everything put in apple-pie order, for the opening ceremony on the 2nd of May next.

In the old part of the ground—that occupied by the late Military Exhibition—the various buildings are of course pretty well ready, any necessary alterations or additions being in progress. It is, however, in the new ground which the executive have annexed, where most activity is being displayed. The gallery for Sir William Armstrong & Co.'s exhibits, which is on the north side, is all but completed, and the large, new gallery on the east side called "The Camperdown" is finished. This is an imposing gallery of 450 ft. by 50 ft., of splendid design, and beautifully finished off internally, the whole effect of which is very fine. Next to it, also on the east side, Messrs. Campbell Smith & Co., of Newman Street, Oxford Street, have made considerable progress with the building of the full-size model of H.M.S. *Victory*. As this firm were the builders of "Old and New London," great things may be expected from them in the construction of their present undertaking. The construction of water basin, 250 ft. by 150 ft., the Messrs. Webster have well in hand, and when completed this will form a splendid sheet of water for various displays, including that of life-saving apparatus. The completion of the pavilion, or grand stand, is being pushed forward, and when ready it will command a view, on one side, of the arena for sports, and on the other, of the water basin, while the erection of the lighthouse is being rapidly proceeded with. The building for the exhibition of Tyler's panorama of Trafalgar is being proceeded with, and when completed will rank largely among the other buildings. In this part of the ground erections are also in progress for the accommodation of the exhibits of the Fairfield Shipbuilding Co., Messrs. J. & G. Thomson (both of Glasgow), and the Royal Mail Steamship Co.

The other buildings are all also in progress, and a commencement has, in one part, already been made in laying out the ornamental grounds.

JAPANESE MAN-OF-WAR.—The construction of a man-of-war was commenced some months back at the Yokosuka Arsenal, Japan. The vessel is to be named the *Akitsusu*, and is expected to be completed in June, 1893. She will be a schooner-rigged vessel, constructed of steel. Her principal dimensions are:—Length, 300 ft.; breadth, 43 ft.; and depth, 29 ft. She is to be fitted with engines of 8,400 H.P.

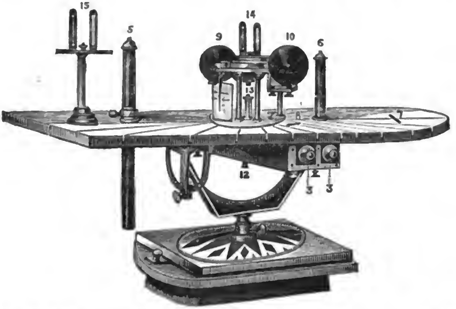

TITE STREET
EXIT
ENTRANCE
NELSON'S GALLERY
BLAKE'S GALLERY
ARENA
Field Gun Batteries and Drills &c.
WATER BASIN
Exhibition of Boat Lowering Apparatus &c &c
St Vincent Gallery Admiralty Guns &c
Sir Wm Armstrong & Co
PANORAMA OF TRAFALGAR AS SEEN FROM THE POOP OF H.M.S. VICTORY
MODEL H.M.S. VICTORY
THE CAMPERDOWN GALLERY
ROYAL HOSPITAL CHELSEA
Scale of Feet

Plan of Ground and Buildings—Royal Naval Exhibition, 1891 (*see page 520*).

BEALL'S COMPASS DEVIASCOPE.

THE Board of Trade having finally, after a preliminary trial at three or four of the principal ports, adopted the Deviascope for use at all their examination rooms, a short account of the instrument will, we think, be of interest to our nautical readers.

The Deviascope is the idea of Captain J. Beall, the head examiner to the Board, who has for years past taken a great interest in the compass and its deviation, having been formerly associated with the Liverpool Compass Committee and Mr. Rundell, its well-known secretary. About five years ago he entrusted the carrying out of this idea to Messrs. H. Hughes & Son, the marine opticians of Fenchurch Street, London, and after various experiments, the present model was produced and called the Deviascope, its objects being to practically illustrate the several co-efficients, how each one is produced, its effect on the compass, and how to compensate and correct the same.



It consists, as will be seen in the illustration, of a large model of a ship's deck mounted so that it can be revolved horizontally over a dumb compass card, and also heeled over to port or starboard to any desired angle.

The deck is fitted with a compass mounted in a brass binnacle or stand, and contains the following fittings as figured on the illustration:—Figs. 3 are two soft iron bars representing the thwartship beams of an iron vessel producing the quadrantal error, or co-efficient D. Another pair of these beams is also supplied, so that a minus D can be produced. Fig. 5 is a soft iron bar representing the stern post or vertical iron of an iron ship and produces the co-efficient E. Fig. 6 is the Flinder's bar for compensating this error. The deck of the Deviascope has 32 radial grooves, and the sub-permanent magnetism or co-efficients B and C are produced by dropping a pair of bar magnets into the opposite ends of one of these grooves according to the position it is assumed the ship was in when building. Figs. 7 and 8 are the deck magnets for compensating this. Figs. 9 and 10 are the soft iron balls for correcting the quadrantal error; they can be moved to and from the compass, and the ring which carries them can also be revolved in azimuth to correct minus D. Fig. 12 is a magnet to produce the heeling error; and Fig. 13 is the small magnet fitted in the binnacle to compensate this. Fig. 14 is the azimuth sights fitted on compass, and Fig. 15 a small pelorus or dumb card with sights.

A clinometer is fitted on front of the binnacle to show the heel of the model.

In addition to the above there have now been added a dipping and vibrating needle to illustrate the measurement of the horizontal and vertical forces and the method of correcting the heeling error.

Captain Beall has compiled a handbook to the Deviascope, explaining fully and clearly the construction and use of the model and the various experiments which can be illustrated by it. A new edition of this handbook has just been published.

It is satisfactory to note that the Deviascope, which was awarded the Gold Medal with diploma at the Liverpool International Exhibition of 1886, has been found, after four years' experience (evidenced by the unanimous and very favourable reports of all those who have used it), to be of the greatest assistance for teaching and examination purposes, bringing clearly before the eye, as it does, in a most simple and practical manner the different actions of permanent magnets, and the actual effects on the needle of the magnetic forces due to the various arrangements, and qualities, of the iron generally met with on board ship, as well as showing the usual co-efficients, and the method of compensating them, &c.; thereby confirming the student's theoretical knowledge, and enabling him to acquire a more intelligent conception of, and a better practical insight into, the action of the various magnetic forces and the subject of compass deviation generally, than it is possible to acquire by means of books alone.

The Deviascope has been ordered for use in all the Board of Trade examination rooms in the United Kingdom, on the Nautical Training Colleges for cadets, H.M.S. *Worcester* and *Conway*, and many other schools in the United Kingdom. It has also been ordered for use by the Governments of South Australia, Canada, and Peru, and the principal training and navigation schools in Sweden, Russia, Finland, China, Japan, &c.

The Deviascope and handbook are to be obtained from Messrs. H. Hughes & Son, 59, Fenchurch Street, London, who are the sole makers.

NAVAL NOTES.

American Naval Activity.

At the present time strenuous efforts are being made by the United States Naval Authorities to improve the condition of the American Navy. Large sums of money have recently been voted, and are now being expended in the construction of various types of war-ships, with the express purpose of bringing the Navy up to the level of some of the European fleets. For some time past attention has been paid particularly to the class generally known on the other side of the Atlantic as commerce destroyers, but quite a new departure is about to be made with the construction of a vessel to be utilised for the express purpose of ramming an enemy. The design for this new ship has been arranged by Rear-Admiral Ammen, of the United States Navy, and includes methods by which the immersion of the hull may be modified at will, when in action. The sides of the vessel are to be protected by steel armour, and the forward end of the ram will be of wrought steel. Subdivision of the hull is a primary feature, there being not less than 102 watertight compartments, while special attention has been paid to the disposition of the material composing the structure, that the maximum strength may be obtained to withstand the strains due to ramming with a minimum weight. The total displacement of the vessel in fighting trim is not to exceed 2,100 tons, and she will be provided with engines capable of developing about 5,000 H.P., from which a speed of 17 knots is expected. In considering the speed aimed at in this novel vessel, its ultimate utility, but for harbour defence, might well be called in question; as in all modern armour-clads and cruisers greater speeds are sought for and obtained, and it is highly improbable that she would be able to exercise her powers of destruction on the vessels of an enemy possessing superior speed, in encounters at sea. The idea of constructing an armoured vessel solely for ramming purposes is not altogether new. Some two years ago Mr. W. Cavett, of Pittsburgh, brought under notice the design for a submarine ram to have a speed of from 20 to 22 knots. In this vessel the ram proper took the form of a piston 12 inches in diameter, working in a cylinder 15 feet long, built into the bow. On approaching an enemy the ram was capable of being ejected by steam with sufficient force to penetrate the side of the heaviest armour-clad.

A New Chilian Steamer.

The contract for the armoured cruiser *Capitan Prat*, which was launched the other day at La Seyne, was secured in 1889 by the Forges et Chantiers, against the competition of several English and German shipbuilding firms, their estimate for the vessel being £4,000 less than the lowest English tender. The *Capitan Prat* is built of steel throughout, on extremely fine lines, which terminate forward in a most imposing ram, and measures 325 ft. between perpendiculars, by 60 ft. in extreme breadth, with a displacement of 6,900 tons, on a mean draught of water of 25 ft. She is protected by a belt of solid steel armour of Schneider manufacture, having a maximum thickness of $8\frac{1}{16}$ in. and a minimum of $5\frac{5}{16}$ in. Although of much smaller displacement, she is 2 ft. longer than the *Magenta* class of French armour-clads, which in some respects she resembles, particularly with regard to the disposition of the main armament. The four large 24-centimetre guns are carried separately in armoured barbettes, one forward, one aft, and one on each broadside amidships. The larger guns, which form part of the auxiliary armament, and of which there are eight, are carried in barbette in pairs. The remainder of the auxiliary armament is made up of eight Hotchkiss revolving guns and five Maxim guns. In addition the hull is pierced for four torpedo tubes on the Canet system. The engines are of the triple-expansion type, capable of developing upwards of 8,000 H.P., the estimated speed being 17 and 19 knots, with closed and open stokeholds respectively. The *Capitan Prat* is the largest vessel ever constructed for the Chilian Navy.

Work at Portsmouth Dockyard.

The torpedo depôt ship *Vulcan*, of 6,600 tons displacement and 12,000 H.P., is being rapidly pushed forward to completion, and it is expected that her official trials will take place early in April, when the most sanguine hope that the estimated speed of 20 knots will be easily attained. All the hydraulic cranes and appliances for hoisting inboard and outboard the torpedo boats, which form part of her equipment, are fitted, and attention is now being centred in the minor details and fittings necessary for her finish. She is to be equipped with a laboratory and workshop, a powerful torpedo armament, a large supply of torpedoes, stores, submarine mines, and electrical appliances. When complete she is to make a voyage round the world for the purpose of remedying defects in the torpedo arrangements of British vessels on foreign stations.

The fitting out of the third-class protected cruisers, *Barham* and *Bellona*, of 1,800 tons displacement, is nearly completed, and the latter vessel will shortly be put through her steam trials. The second-class cruiser *Pallas* is all but complete, and will be ready for the pennant directly her armament, which consists entirely of quick-firing guns, arrives. The battle-ships *Devastation* and *Rupert* are each undergoing extensive overhaul. The latter vessel is to be re-engined with triple-expansion machinery of 6,000 H.P., now being constructed by the Government employés at the dockyard, and will be equipped with a modern armament of breech-loading and quick-firing guns. The gun trials of the new turret-ship *Nile* have been successfully carried out off Spithead. Four rounds were fired from each of the four 13·5-in. 67-ton breech-loading guns, and from first to last the hydraulic gear for working the guns and turrets passed through the ordeal without revealing the slightest defect. The *Nile* was launched at Pembroke dockyard in 1888 and has been in hand for three years at Chatham completing for sea.

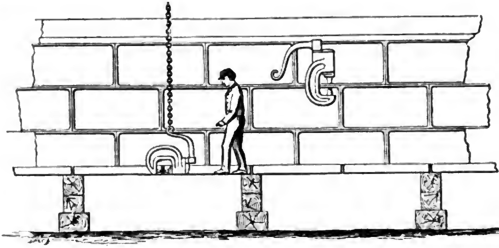
In our last month's issue we referred to the approaching launch of the barbette battle-ship *Royal Sovereign*. On the same date, February 26th, the first-class twin-screw cruiser *Royal Arthur*, ex *Centaur*, was also consigned to her native element in the presence of Her Majesty the Queen. The *Royal Arthur* is one of a class of nine vessels, the construction of which was provided for under the Naval Defence Act of 1889, and is the second to be launched. The *Edgar*, the first launched, left the ways at Devonport some three months ago, and is now having her machinery and boilers fitted on board at that port. Of the remainder the *Hawke* is building at Chatham; the *Crescent* at Portsmouth; the *Endymion* and *St. George* at the Earle's shipbuilding yard, Hull; the *Theseus* and *Grafton* at the Thames Iron Works Co.; and the *Gibraltar* at Messrs. Napier & Co., Govan. The *Royal Arthur* measures 360 ft. between perpendiculars; 60·7 ft. in extreme breadth; with a displacement of 7,700 tons, on a mean draught of water of 24·7 ft. The engines are of the triple-expansion type, capable of developing upwards of 12,000 under forced draught, and 7,500 with natural draught, the resulting speeds being estimated at 17·5 knots and 19·5 knots respectively. The armament is of a powerful nature and includes two 9-in., 22 ton breech-loading guns, ten 6-in. quick-firing guns; sixteen 6-pounder quick firing; three 3-pounders; and eight machine guns. In addition four torpedo tubes are fitted, two above water and two submerged, and she will be fitted with a complete net defence for protection against torpedo attacks. The whole of the vitals are covered with an exceptionally thick protective steel deck, the plating in the most exposed parts being 5 in. thick, while the portions of her vertical engines which protrude above the steel deck are protected by armour 6 in. thick.

The "Alexandra" and "Superb."

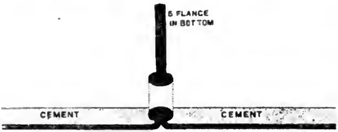
The two armoured battle-ships *Alexandra* and *Superb* have just been added to the effective list of the Royal Navy, after a most extensive overhaul and refit, amounting almost to reconstruction, at Chatham dockyard, and may now be practically classed among the modern armour-clads. The *Alexandra* has been provided with a new set of boilers, and improvements have been made in her machinery which greatly enhances her steaming powers. The armament, too, has been completely changed. The obsolete 25-ton and 18-ton muzzle-loading guns have been replaced by the modern 9·2 inch 22-ton breech-loaders, of which she carries four, and in addition she has been equipped with an auxiliary armament of 14 rapid-firing guns. The total cost of her repairs amounts to about £100,000. A still larger sum has been expended on the *Superb*. This vessel has been fitted with new boilers, and a new set of triple-expansion engines, by Messrs. Mandsley & Co., of London, capable of developing 8,500 H.P. under forced draught, and 7,000 H.P. natural draught, the resulting speeds being 14 knots and 13 knots respectively.

THE HYDRAULIC APPLIANCES SHIP-BUILDING COMPANY, LIMITED.

SECOND NOTICE.



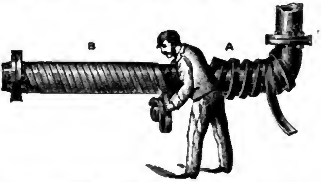
HAVING been furnished with the prospectus of this new company, which has just been issued, we are in a position to give some further particulars relative to the new system of shipbuilding, to introduce which is the main object of the company's existence, and which was dealt with, but in only a very incomplete manner, in an article which was published in last month's issue. We are pleased, at the same time, to be able to place before our readers a couple of illustrations, which show at a glance the extreme simplicity of carrying on the work of ship construction under the new system, and exhibit with great distinctness the principle of the tube rivet, which has been invented to meet a special requirement of this new system, and which constitutes in itself both a fastening medium and a waterway. Those who have read the article on this subject in our last month's number, may remember that this rivet was described as "intended to be used in substitution of the drain-holes or waterways which, in ordinary cellular-bottomed ships, are punched in the floor plates to permit a free passage of water from cell to cell." A rivet or fastening medium of this description was absolutely essential for the practical application of Mr. Holzapfel's ideas with regard to an improved method of shipbuilding, but we are reminded by a statement in the prospectus that this kind of rivet may be usefully employed in ship construction, even as it is now carried on. In every ship where water ballast is provided, we take it that apertures must be made in the floor plates to allow the water to pass freely throughout the whole of the tank, but such apertures must be made clear of the frame or angle bar which connects the floor plate with the shell of the vessel, otherwise a serious loss of strength would accrue. By means of the tube rivet, however, these necessary apertures may be made without loss of strength through the flange of the ship's frame itself, and as close to the "root" or "heel" as an ordinary punching machine can make them. We are disposed to think that this is an advantage which can hardly fail to be appreciated by shipbuilders, and, unless we are much mistaken, the possession of this patent must very soon prove a substantial source of revenue to the company. It is pointed out in a paragraph of the prospectus that the directors of the new company are now building in a London shipyard a small lighter, which is meant in a practical sense to test the value of their system. As the work of this lighter progresses, the defects of the system, if such exist, will be made apparent, and the directors will be able to determine how far the new method of building is likely to realise their expectations, and to what extent it may have to be modified or improved upon. Should the lighter, when completed and tried, be found to justify the expectations entertained of it, the directors intend to acquire possession of suitable premises in which to carry on the work of shipbuilding according to the new system on their own account. The directors say that when and wherever they succeed in getting this system into full operation, "vessels of almost any sizes can be put together ready for launching in a few weeks, by a comparatively small number of men." Assuming that the calculations on which this statement is based are correct, it does not seem to be exaggerated; for it must be remembered that the shaping of the plates for the positions they have to occupy in the structure really constitutes the bulk of the work to be done; as the putting of them together, and the subsequent punching and riveting, are quite subsidiary processes. Let it be granted that the plates are supplied flanged and shaped, and it will then only be a question of a few weeks' steady work to complete the rough structure of the hull of even a very large vessel. The promoters of the new system do not, we imagine, contemplate any changes in the methods of carrying out what we may term the finer portions of the work of ship construction. The greater part of this work, however, such as the arrangement of hatches, cabins, and deck structure generally, could be carried out after launching, and the vessel need therefore not occupy its position on the stocks but for a very brief period indeed. In a season of brisk demand for tonnage, the possibility of shortening the period of occupancy of the building berths would be an immense advantage to shipbuilders, and more especially to those whose building space is limited, and such possibility would allow them to take more orders and get through a much larger quantity of work in a given time. Whatever other characteristics this new system may possess, we are inclined to think that the claim for exceptional strength which is put forward in regard to it must be well founded. The advantages of perfectly "fair" rivet holes, which are secured under this system, are well known to practical men—so well known, indeed, that it is now deemed indispensable for the attainment of the best results in boiler construction, that the rivet holes should be drilled, with the plates in position, instead of being punched in the plates at the punching machines, which was formerly the method universally employed. The object aimed at by drilling the holes with the plates in position, to have the holes completely filled by the rivets without any straining of the latter from their proper shape, thus securing absolute solidity in the rivet area, is as certainly attained by hydraulic punching; and it is an object which is undoubtedly of the greatest consequence. A structure punched and riveted by hydraulic agency after the manner shown in the illustration, ought to be perfectly free from those small interstices in the rivet areas, which are practically inseparable from the present system of hand riveting, and which are admittedly a source of weakness. One paragraph in the prospectus strikes us as stating a truth and at the same time conveying a lesson, which might well be applicable to many situations in life besides the exigencies of shipbuilding. The directors pointing out that hitherto naval architects, in their efforts to apply the hydraulic principle to riveting work, have endeavoured to achieve their object by adapting the machinery to the methods of building in use. This has been found quite impracticable, and though hydraulic riveting has been successfully applied to frame and beam riveting, no one has yet been able to get over the difficulty of applying it successfully to shell work. It did not occur to those gentlemen who were anxious to bring about a more extended adoption of hydraulic riveting to adapt the work to the machinery instead of the machinery to the work. The experiment which is being undertaken by this company is certainly a most interesting one, and we trust that no obstacles of a serious kind will present themselves to prevent it being fairly tried.



CORK COVERING FOR STEAM PIPES.

CORK, being admittedly one of the best non-conducting mediums, would have been greatly used years ago for covering steam pipes, but for the difficulty of bending it to suit different diameters and curves of pipes without breaking. A method has now been invented, however, by which cork in strips can be easily wrapped round pipes of any diameter or shape, from one inch and upwards. This is the system patented by the Cortex Colorifuge Co., Limited, of Hanover Street, Liverpool.

As made and supplied by this company, the cork covering can be applied by anyone, and the accompanying illustration, showing a workman covering a main steam pipe, sufficiently explains the *modus operandi*. The cork strips are backed by specially prepared canvas, which helps rather than retards the compressibility and bending properties of the material, and presents a neat and solid exterior. The smallest diameter of pipe can be expeditiously and neatly covered, and in no case is there any fear of the covering cracking by expansion and contraction as is the case with some of the compositions presently in use.

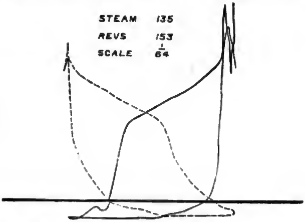


Among the other advantages of cork for this purpose are, its incombustibility even at 390° Fahrenheit; its lightness, its imperturbability, which defies equally heat, frost, and water; its great durability, its resistance of shocks and vibrations of all kinds, and its absolute non-injuriousness to the pipes. The thickness of the cork covering is less than a third of that of cements and other similar compositions.

We understand that quite a large number of merchant vessels have been treated by the Cortex Co. Included in the list are the White Star liner *Teutonic*, the Cunard liner *Umbria*, and the Dominion liner *Vancouver;* in the latter case the cork effecting a most important diminution in the temperature of the engine-room. One of the latest applications of the company was to cover with cork the whole of the steam and winch pipes of the Red Cross steamer *Obidense*, built by T. Royden & Sons, and owned by Messrs. Singlehurst & Co., of Red Cross Street, Liverpool. The pipes as finished have a neat and smart appearance. Water does not damage the cork, and for deck-work it would be difficult to conceive of anything superior to it for neatness and lasting efficiency. Considering the various advantages of cork over other coverings, the price at which it is offered to the public appears very moderate, and the company estimate that as the cork saves close on £2 per square yard per annum, with coal at 10s. per ton, the first cost is made up in six months; while the covering lasts for years. There are certain firms who *will* have first-class ships, and everything in connection with them of the best, and it is with a view of supplying a really first-class non-conductor that the company have introduced this solid cork covering.

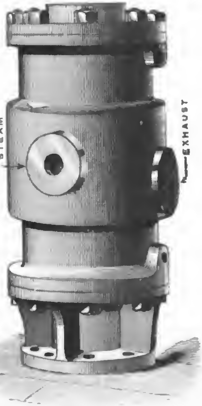
JOY'S STEAM ASSISTANT CYLINDER.

THIS cylinder, which we illustrate, is an invention of Mr. David Joy, Victoria Chambers, Victoria Street, Westminster, and is designed to take the place of the ordinary balance cylinder for valves in overhead engines, but while balancing the weight of the valve and cushioning its inertia, it goes further. Mr. Joy's idea is that it shall also assist to any desired extent in the movement of the valve, and by this means relieve



the eccentrics or other valve-gear of most of their strain.

As will be seen, it consists of only a small cylinder and a piston, this piston acting as the valve in conjunction with special ports in the side of the cylinder. It can readily be applied to any class of engine, it has no loose parts, and nothing to get out of order, and is under perfect, instant, and easy control. We understand that the idea of not only balancing the valves of high-speed engines but actually assisting their movement, was communicated about two years ago to Messrs. Laird Bros. and taken up by them, and tried at first in a less perfect form than that they have now assumed, but they met at the outset with so much promise of success that the firm were induced to continue the experiments, the result being the production of the cylinder shown in the illustration. It has been applied to very high speed boats as well as fitted on other engines, and after a two years' test it has proved to be an admitted success. We also give indicator cards taken from these cylinders at high speeds.



Mr. Joy who is the inventor of the well-known valve gear which bears his name, in this new effort appears to have scored another success. Besides Messrs. Laird Bros. we understand the cylinders have been taken up by other large firms in this country, as well as on the Continent, and have, so far, proved themselves to be all that is claimed for them.

A Roman Ship Canal.—A commission met in the Prefecture Palace in Rome recently to consider a project which has been presented to the Italian Minister of Public Works regarding the [illegible]uction of a ship canal from the coast to Rome.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from January 25th to February 21st:—

Barber, James, engineer to the *Gleaner*, to date February 21st.
Bingham, Percy, engineer to the *Nelson*, to date February 21st.
Brown, William J., chief engineer to the *Hydra*, to date January 26th.
Edgar, Edward J., engineer to the *Swallow*, to date February 20th.
Hines, William, chief engineer to the *Karrakatta*, undated.
Hole, John W., chief engineer to the *Boomerang*, undated.
Hunter, Robert A., assistant engineer to the *Karrakatta*, undated.
Marshall, Frederick W., (probationary) assistant engineer to the *Serapis*, to date February 12th.
Matthews, William Henry, has been advanced to the rank of staff engineer.
Newton, George S., staff engineer to the *Renown*, to date Feb. 18th.
North, Caleb John, has been advanced to the rank of staff engineer.
Parsons, William R., engineer to the *Boomerang*, undated.
Phillips, Richard, engineer to the *Stork*, to date February 12th.
Travis, Albert E., assistant engineer to the *Hecate*, to date February 12th.
Waterfield, Frank, assistant engineer to the *Pearl*, to date January 26th.
Wells, Frederick W., engineer to the *Pembroke*, additional, to date February 20th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, February 20th, 1891.

Teak.—The two large Without Reserve sales held recently have considerably disturbed the market, and very low prices now prevail, making it fairly safe for investors. The market here is well stocked, and all the outports appear full, so that these figures are expected to rule for some time to come. Large quantities of Bangkok timber are reported not far distant, and should the demand continue dull, more Without Reserve sales will be the consequence. The price of planks has fallen, and stocks are getting very heavy while the consumption is small compared with arrivals.

Mahogany.—Since our last the prices for good and sizeable logs, both Honduras and Tobasco, has stiffened, but small stuff remains quiet. The contracts taken for railway panel work have, no doubt, caused values to increase, helped by the fact that several of the best Tobasco cargoes lately arriving have been secured by private treaty, leaving very little of this class of wood in importers' hands. A large private business has, therefore, been done, and most of the timber purchased in this way has already gone into consumption. Other arrivals are expected, and will, no doubt, meet with very willing purchasers. Imports from Panama have found considerable favour of late, and are commanding much better prices. Provided the wood be forwarded in a sounder condition, a ready sale will always be found for this description of mahogany. A parcel of African wood is now due, and may be expected to realize good prices, as these shipments have found such great favour in the north.

Cedar.—There has been a very small demand lately. Stocks are light, and prices have improved slightly.

Padouk.—It is understood that most of the old parcels have been cleared up, and there only remains the one cargo just arrived, which appears to be an improvement on the last in point of condition but not in conversion, as the loss in measure is at least 10 per cent more than in the "Harrington" parcel. This wood has certainly found considerable favour, and with the assistance of the low price is able to compete favourably with Sabicu, African Oak, and other similar tough-natured woods.

Kawrie Pine.—Nothing has been done since the sale without reserve. Most of the wood then sold still remains on hand.

Greenheart.—There is nothing to report in the way of business here, and such high figures are named for distant-arrival cargoes that purchases for this market are quite out of the question.

American Lumber,—Whitewood.—Sales have been forced very much lately, and prime parcels of planks are being offered at 10 to 15 per cent. lower than last month. The arrivals for all classes have been very excessive, and if early realization is required may lead to serious consequences.

WALNUT.—Logs are still going well, and high figures are being obtained for first-class shipments, of which the market contains but a small quantity. For rougher parcels, of which large importations have lately been made, prices rule low. These remarks apply equally to the board trade, as, while prime brands readily sell at profitable rates, inferior and rough qualities are almost unsaleable. The market is glutted with the latter description, and unless more discretion is used by the shippers, the outcome must be very serious indeed for them, as prices will probably rule so low that expenses will barely be covered.

OAK.—Prime quartered boards are readily saleable at fair rates, but discretion as regards shipment is equally necessary with this wood as with other descriptions, the market for all cut stuff being so easily over-stocked.

Business is quiet in most branches, owing no doubt to the unsatisfactory state into which the timber trade has been thrown through the recent collapse of what was known as the "Timber Ring."

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

THE dislocation of trade matters due to the strike of the railway servants is happily at an end, the men having gone in after seven weeks' efforts to coerce the employers on terms which but poorly recompense them for their loss of time. The blast-furnaceman's strike, which for quite a while has been put into the background, is again attracting public attention, owing to one or two of the works having been started and non-union men employed. Picketing on the part of union men is being systematically adopted, and it is very doubtful whether the partial resumption of work will continue and be extended.

Work in the engine shops and shipyards of the Clyde and other Scotch districts is now proceeding at a generally uniform pace, and little trouble is experienced in obtaining coal and other material. A gratifying number of fresh orders have been booked since I wrote my last month's notes; while one or two highly important contracts are in the market, though not as yet definitely fixed.

Messrs. Denny & Bros., Leven Shipyard, Dumbarton, have received the order from a London company for a large steel steamer to be designed for cargo carrying purposes for the Australian trade. The new vessel is to be about 430 ft. long and have a tonnage of about 6,500; she will be fitted with quadruple-expansion engines. The same firm have also recently received an order to build two small steamers of about 120 ft. in length for the Trinity House authorities. Great expectations are attached to the completion and trial of the new Cape mail steamer *Scot*, which is now receiving her machinery by the firm. She is expected to be completed in about six weeks' time.

The Fairfield Shipbuilding and Engineering Co., Limited, entertained the staff at dinner in the company's splendid new offices on the last day of January. Mr. Richard Barnwell, in replying to the toast of "The Fairfield Co.," said it was not unlikely that in the near future the members of the staff would be called on to use their abilities in producing a vessel or vessels larger than any afloat. It is generally understood that this is an allusion to an important order said to be entrusted to the firm by the Cunard Co. for a large mail steamer to be built on the lines schemed out by the Fairfield Co. some time ago, and designed to overtake the Atlantic passage in five days.

Messrs. Murdoch & Murray, Port-Glasgow, have contracted with foreign owners for the construction of five steam vessels—two of which are hopper barges similar to those at present in use on the Clyde, the others screw steamers, for towing purposes; the above builders shipped per steamer *Iris*, recently completed by Messrs. Blackwood & Gordon, three barges for river traffic at Rio de Janeiro.

Messrs. Fleming & Ferguson, Paisley, received early in February an order from the Canadian Government to build a steel screw steamer to be fitted by the builders with a set of their patent quadruple-expansion engines to indicate 1000 H.P.

Messrs. Caird & Co., Greenock, have recently contracted with the Peninsular and Oriental Co. for the lengthening of two of the company's present mail steamers, *Rome* and *Carthage*, and for refitting them with new machinery of higher power and improved design. They have also contracted for the construction of two new steamers of the largest class for the Australian mail and passenger trade, these steamers to be of a higher power and speed than any now running. In these four steamers the adoption of Howden's system of forced draught is a special feature, many important advantages being secured by its use, which on long Eastern voyages contribute largely, not only to increase of speed, but also, from the reduced space occupied by the boilers and economy in fuel, to greater earning power.

Messrs. Scott & Co., Greenock, have booked an order for a 600-ton twin-screw steamer for the China Steamship Co., of Shanghai. She will be supplied by the builders with triple-expansion engines. This firm have also contracted to build two steel screw steamers of 800 tons each for the Brazilian coasting trade. The builders will supply powerful triple-expansion engines.

They have also contracted for a twin-screw steamer of 800 tons for the South American Inland Navigation, to be fitted with twin sets of the firm's triple-expansion engines. A third steamer of 800 tons for the Brazilian coasting trade, similar to the two mentioned above, is also understood to be part of the large amount of new work this firm have booked.

Messrs. Rankin & Blackmore, engineers, Greenock, have contracted to supply the screw steamer *Osprey*, of Glasgow, with a set of Rankin's patent compound twin engines and a new boiler.

The new Clyde river steamer *Lord of the Isles* will be launched early in March. Messrs. D & W. Henderson, of Partick, the builders and engineers, have had all the work on the vessel up till the present done on the old-fashioned plan of day-wages.

Quite a fleet of steel steam yachts are at present being built on the Clyde to the designs and under the supervision of Mr. Geo. L. Watson, the renowned yacht designer. In point of size the most important is a steam yacht of 1,050 tons for a Russian gentleman. The building of this magnificent vessel rests with Messrs. Scott & Co., Greenock. An order of such importance as this would of itself entitle the year in which it was given to a red-letter mark in the calendar of any yacht designer; but dame Fortune, as if fairly bent on doing her very best to make 1891 memorable for Mr. Watson, has so ruled it that he has in addition commissions for steam yachts as follows:—one of 750 tons, two of 350 tons, one of 305 tons, and another of 250 tons. The 750-tonner is for Mr. Ninian B. Stewart, of Glasgow. One of the boats at 350 tons is to the order of the Egyptian Government, and is being built by the Ailsa Shipbuilding Co. at Troon, while the other of this size is for Messrs. J. & A. Allan, Glasgow; Messrs. Fleming & Ferguson, of Paisley, being the builders in her case. The 305-ton vessel is for the Hon. F. G. Wynn, and is being built at Port-Glasgow in the yard of Messrs. Dunlop & Co. The building of the 250-ton vessel has, as in the case of the boat for Messrs. Allan, been entrusted to Messrs. Fleming & Ferguson, the owner being Mr. Peter Coats, of Paisley. Altogether this amounts to 3,055 tons of steam yacht designing that has been entrusted to Mr. Watson in one year, which is surely about as notable a thing as the annals of yachting have to show.

During four days of the first week of February a set of Mr. Hugh Dunsmuir's patent triple-expansion engines for working multiple-screw propellers (an arrangement which we described and illustrated in our issue for April of last year) was shown under steam in the works of Messrs. Dunsmuir & Jackson, Govan. The engines, which have been constructed for the *Wai*, a small steamer shipped to Bombay at the close of last year by the Grangemouth Dockyard Co., are expected to develop 320 H.P. The cylinders are 9 in., 14½ in., and 25 in. diameter, and the stroke 10 in. In Mr. Dunsmuir's arrangement, it may be remembered, the position of the engines in the vessel is changed. Instead of placing them fore and aft as is usually done, they are placed athwart the vessel, and each cylinder drives its own shaft and propeller direct. The crank shafts are joined by side-connecting rods similar to those of a locomotive engine. As the cylinders are designed to produce equal powers there will, in ordinary working, be comparatively little strain on the side rods; but in the event of a propeller being carried away, or a shaft broken, the power will be transferred to the others through the connecting rods. A steamer fitted with the improved engines will be more favourably situated, in the event of

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an accident at sea than with the single propeller. The liability of small propellers breaking is also less. As the propellers are connected, and work simultaneously, the tendency of the engines to race when the vessel rolls is considerably reduced, and the danger of one propeller, through varying speed, dragging on the other is removed.

A noteworthy instance of the promptitude with which contracts can in these days be executed is the case of the manufacture by the Darlington Forge Co., of the single-crank shaft ordered by Messrs. D. & W. Henderson & Co., Glasgow, for the Allan liner, s.s. *Corean*. The forgings for this shaft, which are 15¼ in. in diameter, 9 ft. 4 in. over all, and 5ft. stroke, were commenced on the morning of the 5th Jan., and the shaft was built up, turned, finished, and made ready for despatching by the Monday morning following, the contract being thus completed in six days from its being started, or in five actual working days.

To overcome the great lack of facilities for proper technical education in the University and Colleges of Glasgow, Messrs. Denny & Bros., Dumbarton, have decided upon a scheme whereby deserving pupils at the local Academy desirous of following the profession of shipbuilding or of marine engineering can have, in addition to a college education and simultaneously with it, a course of technical training in their works. Pupils who are successful in gaining a Denny Bursary in the Burgh Academy who evince a desire to follow the above professions will be accepted as apprentices for a period of five years. During the winter such pupils will attend the University and take up the course prescribed for the B.Sc. degree in engineering or in naval architecture, according as they intend to be engineers or shipbuilders, and during the summer they will have the privilege of entering the firm's yard or engine works, where they will be expected to follow the course of work prescribed by the firm, which, I have little doubt, will fit in with their previous studies. They will have the same facilities, say the Messrs. Denny, for acquiring a thorough knowledge of their profession as are accorded to the other apprentices, and will be paid at the same rate as apprentices of the corresponding year. Their time at College will be reckoned as part of their five years' apprenticeship. After the third session at College, apprentices will enter the drawing office and complete their five years there. I see no reason why this praiseworthy system should not be instituted by large firms engaged in other important branches of industry.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

THE TYNE.

Shipbuilding.—The prospects of the shipbuilding industry have not improved during the month of February, and, as compared with this time last year, the aspect of many of the yards is the reverse of reassuring. The orders which were booked last autumn during the temporary spurt which then took place are being steadily worked up; but only in rare instances are any new ones being secured, and, unless things take a better turn very shortly, the state of general inactivity, which has been for some time foreshadowed, cannot be far off. The hopes of a change for the better, which many people are disposed to entertain, have, so far as appearances can indicate, but a poor foundation to rest upon, for the river and docks are largely occupied with laid-up steamers, and one or two builders have new vessels on their hands which they cannot apparently dispose of. These facts go to show that for the present tonnage is not a remunerative investment, and, until it becomes so, no appreciable addition to the work in the builders' hands need be looked for. The Palmers' firm still hold the leading place in point of activity, and the two establishments belonging to the firm are as busy as if the shipbuilding industry were at the flood-tide of prosperity. At the Jarrow yard the bulk of the hands employed are congregated upon the first of the two great war-ships that have been ordered by the Admiralty, and rapid progress is being made with its construction. The firm will launch both the cruisers that are building at the Howden yard by midsummer, and about the same time the second line of battle-ship will probably be placed upon the stocks. The firm have five large merchant ships in hand, all of which are in early [illegible], and they have four or five others being fitted out ir [illegible] Messrs. Hawthorn, Leslie & Co. are preparing to launch one of a number of small steamers which they are building for the South American trade, and the construction of the large Russian vessel, which has been referred to in previous reports, is being rapidly pushed on, the fine weather of the past three or four weeks greatly favouring the progress of operations. Messrs. Armstrong, Mitchell & Co. have the berths of their Low Walker yard pretty well occupied, three of the vessels on the stocks being of exceptionally large tonnage. They have beside the yard three large vessels fitting out and one ready for proceeding to sea. Messrs. W. Dobson & Co. are very favourably situated so far as regards the possession of work. They have a very large vessel in frame, while the keel is laid for another, and a berth is being cleared for the reception of a third. There is therefore every prospect of steady work being maintained at this establishment for some months to come. Messrs. W. Richardson & Co. are also among the number of builders who are not likely to experience any lack of employment for their machinery in the immediate future, as they have two vessels in frame, besides others in preparatory stages. They have also two vessels ready for launching, and one exceptionally fine cargo boat, named the *Holkar*, which has been built for London owners, ready to proceed to sea. Messrs. C. S. Swan & Hunter are scarcely so busy as they were a few weeks ago, and some empty berths are now to be noticed in their yard. The Tyne Shipbuilding Co. are preparing to launch a vessel of large size ordered by local owners, and they have two others in the plating and framing stages. Messrs. Schlesinger, Davis & Co. and Messrs. R. Stephenson & Co. have each but one vessel on the stocks, but at Messrs. Readhead & Co.'s establishment, Tyne Dock, there continues to be a good show of work in progress. Messrs. T. W. Smith & Co.'s yard is quite empty so far as new work is concerned, but the firm have some repair work in hand and a considerable part of the machinery is consequently kept going. Messrs. Wood & Skinner have two berths unoccupied, and the Edwards Shipbuilding Co. have no more than half their building accommodation utilised, while in the case of the Elswick yard, some half-dozen berths are without occupants.

Engineering.—No settlement of the overtime question has yet been arrived at, and the latest that is known with respect to it is that the employers' secretary has received an important communication on the subject from the secretary of the engineers' committee. The contents of the document have not yet been made public, but it may be presumed that it contains the final decision of the engineers as to the exact limitations of overtime required by them. The consideration of this matter has not yet given rise to any great amount of friction, but it is to be feared that, before it is finally disposed of, the friendly relations now existing between the engineers and their employers may be seriously impaired. There is still sufficient work in the marine engineering establishments to keep the machinery going night and day, but this pressure cannot last much longer, as new orders come in but slowly. Messrs. Carrick & Wardale, of the Redheugh Engine Works, are still busy on orders for ships' pumps and chemical plant, and full activity continues to be maintained throughout the large establishment under the control of Messrs. Emerson, Walker & Thompson Bros., at Dunston. Messrs. Clarke, Chapman & Co., who now carry on the business of electric-lighting engineers in conjunction with the manufacture of boilers, steam-winches, windlasses, pumps, and other specialities used in steamship equipment, are well supplied with orders in the various lines mentioned, and are likely to be kept busy for some time to come. Messrs. John Spencer & Sons are rapidly completing the fitting up of their new steel works at Newburn, and the various departments of their existing works continue in full activity. Messrs. Hawthorn, Leslie & Co. are carrying out improvements at their Forth Bank Works, with the view to facilitate the delivery and despatch of goods. There is up to the present no perceptible falling off of work in the iron and brass founding trades, but at the Elswick Ordnance Works there is less activity than was noticeable in the later months of last year. Messrs. Geo. Angus & Co., leather and india-rubber manufacturers, are still doing a satisfactory business, the demand for their engineering specialities being particularly well maintained.

Electric Lighting.—During the past month Messrs. J. H. Holmes & Co. have completed electric light installations on no less than twelve steamers, representing in the aggregate about 1,500 16-candle power lamps, or 150 H.P. Most of these installations were carried out on the "single wire" system, and in each case the well-known "Castle" dynamos were used, coupled direct to high-speed vertical engines. This system has many advantages over belt-driven arrangements, among which may be mentioned the greater immunity from accidents, and the comparative smallness of the space occupied. The whole of the installations were carried out to meet the full requirements of Lloyd's Registry. Messrs. Holmes & Co. have, at present, orders for the lighting of over thirty steamers, some of which include the fitting of Suez Canal projectors, accumulators, and other accessories of a special kind. The very extensive establishment of the firm is now showing the greatest activity, and considering the number of important contracts to be proceeded with, it may be confidently predicted that this satisfactory state of matters will be maintained throughout the year.

THE WEAR.

Shipbuilding.—The annual meeting of the Conciliation Board, which was formed some years ago for the settlement of disputes connected with the shipbuilding trade in this district, was held, on the 18th February, at the office of the Wear Shipbuilders' Association, when the formal business of electing a chairman and vice-chairman for the current year was transacted. This board, since its formation, has been of incalculable benefit to the district; for by its instrumentality wages disputes, which might have culminated in disastrous strikes, have been settled time after time without a day's stoppage of work. It is a matter of surprise that when the advantages of such a medium for adjusting wages claims are made so clearly manifest, the employers and employed in other shipbuilding centres do not follow the example of those in Sunderland, and thus provide themselves with a most effective means of avoiding conflicts that are equally detrimental to the interests of both. It has not transpired that any orders have been placed with local builders lately, but most of the leading firms have a sufficiency of orders to keep them going for some time to come, and the absence of new orders will, consequently, not be very keenly felt just yet. Messrs. J. L. Thompson & Sons are preparing to launch a large vessel for Liverpool owners, and they have a still larger one in frame that is intended for the tea trade. They have also a handsomely modelled steamer building for Spanish owners, and two or three others that are understood to be ordered on local account. The Sunderland Shipbuilding Co. are fitting out for sea the fine steamer *Braunfels*, which was launched towards the end of last month, and is the tenth built by the firm for the "Hansa" Co., of Bremen. They have three vessels on the stocks, all of which are in early stages of construction, and there is therefore a fair prospect that the yard will be kept busy during the next three months. The plating of a vessel has just been commenced at Messrs. Bartram & Haswell's yard, but there are no indications of other work coming on, and it is probable that slackness will soon be felt at this usually busy establishment. Messrs. R. Thompson & Sons have the whole of their four berths occupied, three of the vessels being in early stages, and one ready for being launched. The firm have repair contracts in progress at the Bridge Dock, and are just now employing a more than ordinarily large number of hands. At Mr. Laing's yard the state of work is satisfactory, and at Messrs. Short Brothers' establishment, where a temporary cessation of furnace work took place a few weeks ago, through the putting down of new plant, operations have been fully resumed, and all the departments are now very busy. Each of the last mentioned firms have four vessels on the stocks, and it is understood that in each case there are more orders to follow. Messrs. W. Doxford & Sons have most of their berths occupied, and Messrs. J. Priestman & Co. are utilising the whole of their building space. Messrs. Pickersgill and Messrs. S. P. Austin & Son have each two vessels on the stocks.

Engineering.—At some of the marine engineering establishments, symptoms of incipient slackness are beginning to be noticeable, and this is not to be wondered at, seeing that very few, if any, new orders have been booked for some months past. The tactics of the operatives in putting forward claims in restriction of overtime may, to some extent be responsible for this; but whatever the cause, there can be no doubt of the fact that the pressure of work has appreciably decreased. There is also a sensible falling off of business to be noticed at such establishments as are devoted to the manufacture of steam winches and steering gears; but a few of the smaller engineering works continue to show evidences of activity. Among these may be mentioned the Bloomfield Works, belonging to Mr. A. A. Rickaby, whose specialities in piston-rod packing, &c., are steadily gaining ground in the estimation of engineering experts. The Monkwearmouth Iron Works continue well employed, a good proportion of the work in hand coming from local shipbuilders. At the Castletown Steel Works business is also active, and the local chain and anchor works are doing a fairly satisfactory trade. Rope works are still kept pretty busy, particularly the establishment of Messrs. Craven & Speeding, where the strike of women workers has just been settled by the concession of 1s. per week all round advance on the wages rate. The dispute at Silksworth colliery, which has been referred to in previous reports, has reached an acute stage, a number of the recalcitrant miners, with their families, having been evicted from their houses, which, as is usual in the mining districts, belong to the owner of the colliery. Further complications are now looked forward to, as it is thought that the miners at other Durham collieries will turn out on strike, as an expression of sympathy with the Silksworth men.

The Hartlepools.—The shipbuilding establishments at both East and West Hartlepool are still kept pretty busy, the large quantity of repair work which comes to the port helping materially to supplement the new orders that are in hand. Since the opening of the year the following vessels have received their machinery at Messrs. T. Richardson & Son's sheerlegs:—The s.s. *Oil Rivers*, owned by Messrs. Edward Dempster & Co., of Liverpool, with cylinders 23 in., 38 in., and 61 in. by 3 ft. 6 in. stroke, and two large single-ended boilers, constructed to work to a steam pressure of 160 lbs.; the s.s. *Vala*, owned by Messrs. Carlisle & Co., of London, with cylinders 22 in., 35 in., and 59 in. by 3 ft. 3 in. stroke, and two large boilers, built for a working pressure of 160 lbs.; the s.s. *Chatfield*, owned by Messrs. F. Woods & Co., London, engines 24 in., 38 in., 64 in. by 3 ft. 6 in. stroke; the s.s. *Dunmurry*, owned by Messrs. Boyd Bros., Belfast, with cylinders 22 in., 35 in., and 59 in., by 3 ft. 3 in. stroke. The following vessels, engined by Messrs. Richardson, have had successful trial trips in the time indicated, and have left for their several destinations:—The s.s. *Glenisle*, owned by Messrs. Livingstone, Connor & Co., of West Hartlepool, on January 17th; the s.s. *Dunmurry*, on February 11th; and the s.s. *Vala*, on February 17th. The manufacture of Morison's evaporator now forms an important feature of Messrs. Richardson's operations, and as the merits of this speciality are becoming more widely known, orders are being received in increasing numbers. The owners of the s.s. *Oswestry* (Messrs. Sivewright, Bacon & Co., West Hartlepool), in testifying to the efficiency of the apparatus, state that on the vessel named as well as on several other vessels of their fleet in which it has been fitted, it is giving complete satisfaction, effecting an economy of fuel, and maintaining the boilers in good condition throughout a voyage, besides minimising the wear and tear, cleaning expenses, &c. The chief engineer of the *Oswestry* corroborates this testimony, and says he can work his boilers perfectly fresh. This vessel has been away from England ten months, and though on her different journeys, the last one of which occupied 60 days, she has averaged a speed of nearly nine knots, the boilers on being opened out at Liverpool were in perfect condition, having a scale no thicker than an egg shell, which was quite soft and easily removable. The owners of the *Oswestry* further state that before the evaporator was fitted, they had a serious accident from collapsed furnaces, but the occurrence of such an accident they now look upon as impossible, and they entertain no doubt that where the evaporator is used the life of the boilers must be materially prolonged. It may be added that these owners intend fitting the apparatus in two new steamers which they are now getting built. At the Central Marine Engineering Works there is as yet no appreciable falling off in the output, though new orders are being booked but slowly, and there seems every prospect of a dull time setting in towards the close of the year. Since the opening of the year the engines and boilers of the steamers *Buckingham*, *Blenheim*, and *Bramham* have been fitted on board, and the large steamers *Guernsey*, *Heighington*, and *Taurus* have had highly successful trial trips. The effects of the strike in the foundry department in the latter part of last year have not yet been quite overcome, as the large quantity of castings that had then to be ordered from districts where wages are lower have not yet been all delivered. The attitude of the workmen in some of the principal departments in threatening the entire cessation of overtime, and in asking for still higher wages than those now current, tends to restrain the employers from undertaking fresh contracts, and to make work much more difficult to procure, owing to the enhanced prices that must, under the circumstances, be quoted. Th steel works continue to be kept busy, the local consumption for shipbuilding and boiler-making purposes being still very large. Rope works are also fully employed, but some of the other local industries are not quite so active as they were a few months ago.

Stockton.—Shipbuilders at this centre have still a large amount of work in hand, and very few empty berths are as yet to be seen. There is not much to complain of regarding the state of business in the engineering establishments, Messrs. Blair & Co. continuing to occupy a leading position so far as regards the number and importance of the contracts in progress. Since January 20th the following steamers, engined by the firm, have had their trial trips:—The s.s. *Vera*, built by Messrs. Thos. Turnbull & Sons, of Whitby, for Messrs. Thos. Marwood & Sons of the same port, having engines of 175 H.P. nominal, with cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The s.s. *Justin*, built by Messrs. Raylton Dixon & Co., for Messrs. Arthur Holland & Co., of London, having engines of 160 H.P. nominal, with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke. Both the above sets of engines are constructed to work at 160 lbs. pressure of steam, and on their trials gave complete satisfaction.

Middlesbro'.—Messrs. Raylton Dixon & Co. have several vessels of large size on their stocks, and are also having a good share of repair work. The state of business at Messrs. Harkess & Son's establishment is satisfactory, repair contracts in this case also forming a good proportion of the work in hand. The Teeside Engine and Iron Co. are busy in most of their departments, and the extensive works of Messrs. Bolckow, Vaughan & Co. are kept in steady operation. Messrs. Westgarth & English, marine and general engineers, have several contracts in course of execution, and the principal iron-founding establishments are maintaining a good average output. Some heavy orders for rails have recently been placed with local steel manufacturers, and there is a prospect that in this industry full work will be maintained throughout the whole of the year.

Darlington.—The contracts in hand at the Darlington Forge Co.'s works are both numerous and important, and though similar establishments elsewhere are beginning to feel the effects of diminished ordering of new tonnage, there appears to be little probability of any serious slackness occurring at these works for several months to come. Waggon works are very busy, and steel works continue in full activity.

Consett.—The Consett Steel and Iron Works, which are among the most prosperous as well as the largest concerns of the kind in the country, are exceedingly busy in all departments, the output of plates and angles being maintained up to the very high average of recent months. The threatened strike in the Durham coal trade, should it take place on the extended scale that is apprehended, will materially affect business at this, as well as most other industrial establishments in the North, and it is to be hoped that means may be found by which so great a calamity may be avoided.

NORTH-WEST OF ENGLAND.

Barrow-in-Furness.—There has not been much that is new taking place in the iron shipbuilding and engineering industry of this district during the past month. All departments are very busily employed—a position of affairs which has existed for many months past, and which is likely to be maintained throughout the current year. Of course, even with the very full programme of work which is in hand the central departments of the trade soon begin to clear out the orders, so that a continuous inflow of work is necessary in order to keep full and regular employment all round: no new orders have, however, been accepted during the month, and as a matter of fact very few have been on offer. There is such a large tonnage of shipping standing idle, and the shipping trade seems to be going from bad to worse—as much from the fact that the dockers in various parts of the country are uneasy as to their wages, as [illegible] the fact that there are fewer imports and exports to be [illegible] with; indeed, so marked a tone of quietness has set in, that [illegible] cases where shipowners contemplated placing [illegible] for new tonnage, a waiting policy has been adopted. [illegible] this state of things it would appear probable that the [illegible]pects of shipbuilding in the immediate future are not in any [illegible] satisfactory. There is always this cheering fact in con[illegible]tion with shipbuilding—that certain shipowners who are compelled to make additions to their fleets are from time to time necessitated to add new fast steamers, and as the cost of modern liners is now a very great item, advantage is naturally taken of times of quiet trade and low prices. There are prospects of some very good orders at Barrow in connection with new developments in steam shipping enterprise which have already met with the approval of some great financial houses, and which will represent orders of great magnitude and importance. Apart from work of this character, however, the outlook is not assuring, but it is satisfactory to know that before the spring is reached definite and important progress will have been made in the realisation of one of the greatest schemes of shipping enterprise which has ever been known, and which will be promoted under the auspices of the Imperial Steam Navigation Co., Limited.

The success of the trial trips of H.M. cruiser *Latona*, built by the Naval Construction and Armaments Co., are not only eminently satisfactory to the builders themselves but to the Admiralty, the *Latona* being the first of this class of cruisers which has been delivered. She was built to develop 9,000 I.H.P., but on force-draught trial at Portsmouth she indicated 9,438 H.P., and achieved the marvellous speed of 20½ knots. The engines of the *Latona* are of apparently light construction, but they have been schemed to give the maximum of power with the minimum of weight, and their success as already ascertained is regarded as an important event in the engineering world, and one which will doubtless exercise some influence on future designing of high-speed engines in ships of comparatively small displacement.

Much progress has been made in the completion of the *Empress of Japan* at Barrow, and she is expected to be delivered to her owners at Easter. In the meantime the sister ship, the *Empress of China*, will be launched, and at an early date other launches will take place from the Barrow yard of steamers of small size which are well forward in plating.

It is noteworthy that in the marine engineering department there is much activity at Barrow, and that plenty of orders are in hand which will maintain existing activity for a long time to come. In fact, the necessity which exists for the prompt extension of the engineering department of the Naval Construction and Armaments Co.'s works, following the extensions already made in the boiler shop of the same establishment, is indicative not only of the great trade being done, but of the greater attention which is now paid to the building of fuller-powered engines for modern shipping.

The price of shipbuilding material has decreased during the month. Plates are at £6, and angles have gone up to £6, as there is no more competition for the former class of goods. The mills at Barrow are fully employed, but those in West Cumberland are stopped. Prospects of new orders are not good.

West Cumberland.—The shipyard at Whitehaven is still closed, but a steady though not brisk business in the building of sailing ships is being carried on at Workington and Maryport.

THE MERSEY.

THE position in the shipbuilding branches of industry throughout this district remains about stationary. There are a fair number of enquiries with regard to new vessels, but these almost without exception are based upon very much lower prices than shipbuilders on the Mersey would be disposed to entertain, at any rate under the present unsatisfactory conditions of labour and the continued high rate of wages. Notwithstanding the steadily increasing depression which has recently come over the shipbuilding industry and the impossibility of securing work except at prices which are altogether unremunerative, there is a continued agitation on the part of the men in one branch or another, and in various forms, all still tending in the direction of higher wages and consequently increased cost of production. During the past month the employers on the Mersey have received from the labourers in the shipyards demands for increased rates of pay, and generally the attitude of the men continues to be one of uncompromising hostility to what they must know to be the legitimate needs of the employers for some relief on the cost of production. Certainly there has been a very considerable reduction in the price of all descriptions of raw material, steel ship-plates and boiler plates especially having dropped to an extremely low point, but this alone is not sufficient to enable shipbuilders, except at a very serious loss, to compete for new orders on the basis of the prices at which it would now seem only possible to secure them. The result is that on the Mersey there is extremely little new business being secured, and during the past month there has been practically nothing placed beyond a few repair jobs and other similar work. Messrs. Laird Bros., of Birkenhead, continue very busy on the important contracts they have in hand, and during the month they have launched an iron twin-screw steamer named *Sir Richard Grenville*, which has been built, to the order of the Great Western Railway Co., for service as a mail and passenger tender at Plymouth. The vessel has been built to Lloyd's rules for their highest grade of classification and is about 132 ft. long by 39 ft. beam, and 545 tons o.m. She is to be fitted with two sets of triple-compound engines driving twin-screws and will have a speed of about 12 knots. Spacious deckhouse accommodation, fitted with every comfort for passengers, is provided, and the steamer will no doubt prove a very useful vessel for the service, as well as for pleasure excursions, for which she will be specially suited. Steady progress is being made with the line-of-battle ship, the *Royal Oak*, and Messrs. Laird have now completed all the work required of them on the *City of Paris*, which has been undocked ready to proceed to Glasgow to receive her new engines. With regard to the shipbuilding yards on the Liverpool side of the Mersey there is nothing new to report, the several firms proceeding with orders in hand, with nothing new at present coming forward.

With regard to the general engineering industries of this district a fairly satisfactory position is still maintained. Stationary boiler-makers continue well supplied with orders for inland requirements, and also for abroad, and report a considerable weight of new business coming forward. Stationary engine and locomotive builders are also very busy, and upon railway rolling stock generally the leading firms in this district have work either in hand or in prospect to carry them well over the present year. Machine-tool makers are also kept fully engaged with work in hand, whilst, with few exceptions, there are no complaints of any serious slackening off so far as the immediate future is concerned. Engineers engaged on marine work, however, continue very quiet, and report little or nothing of any moment coming forward except it is in repair jobs or alterations. Taking the engineering trades generally there are some indications that new work is tapering off, but so far not to the extent to cause any serious apprehension with regard to the future beyond the undoubted depression prevailing in marine work and shipbuilding. The reports of the trades union organisations for the past month again show a slight increase of unemployed members in this district, but the total number on the books in receipt of out-of-work support is still exceptionally small, the Amalgamated Society of Engineers not having more than two per cent., and the Steam Engine Makers only one per cent. of their members in receipt of out-of-work donation. A noticeable feature, however, is the increase of moulders and pattern makers who are now out of employment, which may be taken as an indication of a lessening quantity of new work actually in preparation, whilst as regards the men generally, although employment is still maintained, workmen who from one cause or another are discharged, do not so readily find re-employment as was the case only a few months back. It may therefore be regarded that so far as there is any movement in trade it is certainly in the directon of decreasing activity.

In the annual report just issued by the Steam Engine Makers Society (whose centre is in Manchester), which is always the first to make its appearance, the general secretary, Mr. James Swift, makes special reference to the shipbuilding industry, and and it will be interesting to quote what the opinions of a well-known trades union leader are upon this subject. The Steam Engine Makers Society is one of the oldest organisations of its kind in the country, this being the 66th year of its existence, and although nothing like so large in membership as the Amalgamated Society of Engineers, it is a prudently managed and steadily progressing society. During the past year the income has amounted to £15,849, and the expenditure to £10,552, leaving a balance of £5,296, and bringing the funds of the society up to a total of £24,653, which makes the capital worth of the society greater than at any former period, whilst the number of members has increased during the year from 5,500 to 5,822. Mr. Swift in his introductory remarks to the report states that last year allusion was made to the great factor which shipbuilding had become in relation to the engineering trade generally. This position had been maintained during the year, and shipyards being fully employed there had been equal activity in inland towns not directly connected with shipping. At the early part of the year there was a limitation of orders, but before the summer closed this had been reversed, as additional orders for steamers had been booked and briskness had continued in marine centres. The majority of the vessels were constructed in steel, which was now so extensively used, and as one writer put it, this material enables a ship to be built with 17 per cent. less weight in material then if constructed in iron, whilst this and the improvement in engines and machinery enabled carriers to convey produce to our shores at about one fourth the cost of ten years ago. "Seeing the important bearing which this industry has upon the employment of members it will be interesting," Mr. Swift proceeds "to show that at the commencement of the present year (1891), the amount of shipping under construction at British ports was 471 vessels, representing 734,000 tons against 872,000 at the commencement of 1890. In addition to this preparations were being made for building other 178 vessels, representing 293,285 tons, whilst the same authority gives the tonnage under construction (January, 1891) at foreign ports as—Germany, 49,900 tons; Holland, 23,000 tons; Italy, 23,900 tons; and the United States, 32,300 tons. The totals of these four countries being 129,100 tons. If, therefore, past results are again a reliable barometer, we may take it that fair employment will be found during the year on which we have now entered. It may not be so extensive, but if fairly distributed and not confined to any certain locality and district, it will be matter for satisfaction and to the benefit of all concerned. Looking back upon the year just closed it may be considered as one which has been favourable to both the employers and employed. The former admits that profits have been higher than for some years past, whilst orders have been abundant at a remunerative rate. The employed have taken advantage of this, and in our own trade in numerous cases advances have been secured whilst numerous trade customs have been consolidated. It will be to the benefit of all if the latter can be maintained when slack times come round again and a fair tax kept on overtime to limit an admitted evil, but one often indulged in by both parties concerned. One great argument used against us when trade disputes have occurred in moderate times has been the low rates paid in certain competing districts. During the year an effort has been made to remedy this and these districts have been successful in establishing a higher standard than had before existed. In dealing with this point the first question that had to be met was the number of non-society men and the help that would be accorded them. Some of these became members of societies, but others held aloof and preferred to take the risk of what they might receive by voluntary subscriptions rather than provide for themselves by joining a *bonâ fide* society. To understand this spirit is an enigma as the fact is so palpable to them that their weekly rates were considerably lower than in other towns where their class of labour was predominant. This feature in the trade was well known, and it is a rare occurrence that we are not reminded of the fact when combating with employers in districts who pay a much higher rate. Whilst, however, such a state of things has existed in the past, it has been equally evident that the volume of trade did not flow unevenly, as the better paid districts had an equal if not a higher share of business than their unequal competitors." Mr. Swift may be regarded as one of the old type of trade unionists, and he concludes with a paragraph which is evidently intended as a warning with regard to what has been termed the "new unionism" which has sprung up during the last two or three years. "All trade unionists," he says, "were pleased to see the strides that combinations had made in the past two years, as the doctrine had been preached by them for a long period, and every effort put forth to advance its principles. What was now feared was that their zeal might overrun their discretion and overlook the need for making some provision for the future, and then with the first decline in trade lapse into the old state of want of financial strength and unity of purpose. They knew from past experience that the system adopted by the last generation had worked for the benefit of those who were left as well as those who had gone before. This system, coupled with a reserve fund to use if necessity require it, had regulated the terms of employment both as to wages, hours, and trade customs, and that without any extensive trade struggles taking place. Such results had been secured without any resort to force such as was exposed by the Royal Commission in 1866, and in the interval trade-unionists had maintained a reputation as honourable belligerents in industrial warfare. Having done this there could be no desire to go back upon the days when to admit being a trade unionist was done with timidity; but the past having been obliterated made it a credit to assert that they were members of such an organisation at the present time.

In the iron trade of this district business during the past month has remained in an extremely depressed condition, with a continued downward tendency in prices, and buying going on only from hand to mouth. So far as makers both of pig and finished iron are concerned, the position is daily becoming more serious, as business is altogether impracticable except at prices which leave a considerable loss upon the actual cost of production. This is especially the case with regard to makers of finished iron, who generally complain that to sell at present prices means a loss of fully 10s. per ton on the cost of production. Naturally, neither makers nor manufacturers are at all anxious to sell largely under the present unsatisfactory and ruinous conditions of the market, and in some instances a stoppage of works is talked of as more preferable than to continue to sell at the present unremunerative rates. Consumers, on the other hand, have evidently no confidence to purchase in any quantity beyond actual requirements, and generally the outlook of the market is most discouraging. For delivery equal to Manchester the average prices for pig-iron with the close of the month are about 47s. to 48s. for forge and foundry, Lancashire; 45s. to 47s. for Lincolnshire, and from 44s. 6d. and 45s. up to 51s. and 51s. 6d. for the better qualities of Derbyshire iron, less 2½; outside brands offering here average about 50s. 10d. to 51s. 4d. for good-named foundry, Middlesbro' with Eglinton, obtainable at about 56s. 6d. to 57s. net cash.

In manufactured iron the position, as already intimated, is even worse than with regard to the raw material. Forge proprietors, even at prices which leave a considerable loss upon the cost of production, find it difficult to secure orders to keep their works going, and for delivery in the Manchester district good ordinary qualities of bars do not average more than £6, hoops £6 5s., and sheets £7 7s. 6d. to £7 10s. Nut and bolt makers also report business restricted to very small dimensions, and new orders only obtainable by a constant cutting down in prices.

In the steel trade business also remains in a very unsatisfactory condition, and there has been a steady easing down in prices during the month. In raw material the business going out has been only very small, and good foundry qualities of hematites have now got down to about 61s. 6d. to 62s., less 2½ delivered in the Manchester district. For steel plates prices vary considerably, but the tendency has been in a decidedly downward direction. The best qualities of local and Scotch plates, suitable for boiler-making purposes, are now obtainable from makers at about £7 15s. to £7 17s. 6d. per ton, delivered to consumers in the neighbourhood of Manchester, with merchants underselling even at these low figures, whilst common qualities of steel boiler-plates from the North of England are obtainable at as low as £7 5s. to £7 10s. per ton, delivered here. In steel ship-plates there is a continued absence of enquiry of any moment in the market, and exceedingly low figures are here and there being taken for special lots, there having been sellers at something like £6 10s. per ton, delivered *ex* steamer Liverpool, although makers' quotations for anything like good qualities of steel ship-plates are not under £6 15s. to £6 17s. 6d. per ton.

In the metal market prices have fluctuated considerably during the month, the easier tone in copper having given a downward tendency to list rates for manufactured goods; but with the close of the month there is a much stronger tone in the market, and for all descriptions of manufactured goods an active demand is reported, with prices for delivery in the Manchester and Liverpool district firm, as under: Solid drawn brass boiler-tubes, 7¼d.; solid drawn brass surface condenser tubes, 8¾d.; solid drawn copper tubes, 8¼d.; brazed copper steam tubes, 8½d.; brazed brass tubes, 8¼d.; yellow metal condenser plates, 6½d.; brass wire, 6¾d; copper wire, 8¼d.; rolled brass and sheet brass from 7d. to 8d.; cast composition sheathing nails, 7½d.; and wrought copper boat nails from 10d. to 11d.

The condition of the timber trade remains without improvement. There are excessive supplies in the market, and with large stocks generally held by shippers, the outlook is not at all encouraging. In most branches of the timber trade, it may be added, the business has been very unsatisfactory for a considerable time past, and, although the imports have been considerably reduced, these have been more than ample for the demand.

The coal trade has quietened down considerably during the last two or three weeks, and in all descriptions of fuel there are more plentiful supplies in the market, with a slight easing down in prices on some descriptions. The shipping demand continues fairly good, but with supplies coming to hand at the ports on the Mersey more freely than they have been doing of late, prices have given way to some extent, and, certainly, buyers are now under no necessity to pay any exceptional figures to secure cargoes. For delivery at the High Level, Liverpool, or the Garston Docks, good qualities of steam coal do not now average more than 10s. 3d. to 10s. 6d. per ton.

THE THAMES.

THE brisk business on the Thames, with which the year opened, has, we are pleased to say, been fully maintained during last month.

Shipbuilding.

At Messrs. Samuda Bros., Limited, work on the *Sappho* and *Scylla* is being rapidly pushed forward, while the work they have in hand for the Victoria Steamboat Association, as well as for the South Eastern Railway Co., keeps all their departments busy. In armour plates they have all their work cut out for them for some time to come, and generally their works are employed to their full extent.

The Thames Iron Works and Shipbuilding Co., Limited, at Blackwall, are making rapid progress with the completion of H.M.S. *Blenheim*, now lying in the Victoria Docks. A model of this splendid 9,000 tons cruiser will appear at the Naval Exhibition, as well as one of the *Grafton*, a cruiser of 7,350 tons. This latter will probably be launched in the course of the present year. Her sister ship, the *Theseus*, is in a forward state, and will, it is expected, be launched in the early part of 1892. In their ship-repairing department, this firm has been occupied without intermission for some weeks past, and, among others, they have the telegraph ship *Lady Carmichael* in hand. They are also engaged upon a large contract for machinery for the London County Council, for the Sewage Precipitation Works at Crossness.

At Messrs. Yarrow & Co.'s establishment, good progress is being made with the work we mentioned last month as being in hand. The Portuguese Government is at the present time putting together on the banks of the Pungivé river two of this firm's shallow-draft steamers, which are being fitted out as gunboats. This river is one which, in the near future, will play an important part in the development of the district, having a good harbour at its mouth, a fair depth of water for about 100 miles up, and leading into territory claimed by the British South Africa Company.

Engineering.

On visiting the engineering works of Mr. Peter Brotherhood, in Belvedere Road, Westminster, we found them fully and actively employed. While Mr. Brotherhood has turned out large plants of various descriptions for foreign governments, he is at present almost exclusively occupied with work for the British Government. He is constructing large numbers of air compressors for the torpedo service, in sets of four compressers and eight reservoirs for each vessel, the pumps being capable of working to 3,000 lbs. per square inch, although in H.M. Service 1,700 lbs. is about the maximum pressure required. The arrangement in these pumps for keeping the air delivered cool, by water, is very ingenious, and the result is, that it never reaches more than one or two degrees above ordinary heat. All these compressors are tested to their maximum before being sent out of the works, a well ordered and complete branch of the establishment being set aside for this purpose. In Mr. Brotherhood's specialty, that of engines for fan driving for forced draught, great activity is displayed. He has, we believe, turned out 800 of these, and at present has on hand orders for supplying several of H.M.'s ships with them. We may mention that he has supplied Messrs. Denny & Co., of Dumbarton, with these engines for the Ostend boats built by them, and also for the Australian cruisers built by Messrs. J. & G. Thomson, of Glasgow, as well as to the *Latona*, which recently had such successful trials. He has also an order for 24 engines of one size for the electric lighting of H.M. battle-ships. These are of most beautiful design, construction, and workmanship, and are to be coupled direct to Messrs. Siemens Bros. & Co.'s dynamos. We saw several of them awaiting testing in presence of Government officials. This is also done in the works before being sent out, a most efficient plant being erected for this purpose. Mr. Brotherhood makes all his own castings, one department being set aside for iron, and another for brass. The castings turned out here are very clean and perfect, and do not require any tool touching up prior to being placed in position, a thing all the more remarkable as some of them are rather complicated. When going through these works one, for a time, is somewhat at a loss to discover the engines which drive all the machinery, but these are at last found in the shape of twin small tandem compounds driven at 400 revolutions per minute, and developing from 23 to 24 H.P. each. Two very efficient electric plants supply the lighting, each man having a separate lamp to himself directly in front of his particular work; while the whole works are heated up by Perkins' heating stoves, thus avoiding a lot of small ones scattered through all departments. Mr. Brotherhood's large works are very compact, well arranged and kept in beautiful working order, and furnished with the latest and best tools adapted for turning out the work required, and we understand that he does all his work to order, and none for stock.

Messrs. Merryweather & Sons, the well-known fire engine and steam tram makers, of Greenwich Road and Long Acre, London, are busy with steam fire engines and other light high-pressure machinery, among recent orders being engines for Hull, Pontefract, Wigan, Fenny Stratford, and other English towns, and also a number for South America. They are also employed on fixed engines for five boats. The London Fire Brigade have three of their "Greenwich" patterns in constant use, two of them delivering 1,400 gallons per minute each, and one throwing 1,000 gallons. They have also fitted with engines, steam fire floats for Liverpool, Hartlepool, Newcastle-on-Tyne, Hull, and other ports, while the authorities at Alexandria (Egypt), have a large boat fitted by them capable of steaming ten knots an hour, and throwing four powerful jets, which has several times saved the shipping in that harbour from destruction by fire. Our own Admiralty have of late years provided many of their new men-of-war with this firm's steam fire pumps. They have supplied engines for H.M.S. *Valiant* and *Hotspur* and other ships, and have just constructed one of their fixed "Greenwich" engines for H.M.S. *Asp*. This engine will deliver 600 gallons per minute, and can be used for pumping out the holds or bulkheads in case of a leak, as well as for fire extinguishing.

At Messrs. Caird & Rayner's business is still very brisk, and their hands are full in the execution of the large orders they have on hand for their evaporators, while the turn out of the large copper coils we mentioned last month, still occupies their attention.

ELECTRIC LIGHTING.

Messrs. Crompton & Co. are still busy at their Chelmsford Works. They have received large orders recently for isolated plants, and the tendency seems to be to order very much larger machines than formerly. The efficiency is very largely increased in large dynamos, and it is found more economical to use these than was the custom some years ago. The lighting of towns, as formerly, is receiving considerable attention, and this firm have at present as many as five or six central stations in hand. Northampton is progressing rapidly, and it is expected shortly to make a start in the regular supply. Southampton has several miles of mains already laid, and the work is being pushed on with as large a number of men as possible. The London districts under the care of Messrs. Crompton & Co. are extending very rapidly, notably in Kensington, Westminster, Notting Hill, Knightsbridge, &c. Upwards of 20,000 lights have recently been added to these stations, and the work of extension is going on as fast as possible. One of the most important features in connection with this firm's business is the transmission of power, and it is possible this will occupy the company's attention more largely than ever this year. They have already large orders in hand for dynamos and motors for mining machinery, and the economy gained by using electricity has recently been shown by mining engineers to be at least two-and-a-half times as great as that from compressed air. The dynamo is placed at the pit's mouth, and the motor at the bottom of the shaft, and as high as 65 to 75 per cent. efficiency can be obtained. Messrs. Crompton & Co. have just received an order for lighting a town in South Africa, which will come to many thousands of pounds, and orders are pouring in fast on them from Australia and elsewhere. Altogether the outlook for this year is one of the brightest, and as the firm manufacture all the machinery they sell, their hands will be fully employed for some time to come. We cannot omit to mention one very curious feature in Messrs. Crompton's business, and that is the export of dynamos to America. An order for several of these has just arrived, and this, we understand, is only a repeat of an order executed a few months ago. It seems all the more funny that Americans, who pride themselves on electrical work if on anything, and who have raised the tariff to a duty of 45 per cent., should not be able to compete advantageously with this firm. We believe, however, that the real reason is that the machines manufactured by Messrs. Crompton & Co. have given less trouble than those supplied by firms across the "herring pond."

The Brush Electrical Engineering Co., Limited, are still busy on the contract for supplying three large men-of-war ships for the home government, as well as the two armoured cruisers for a foreign government, which we mentioned last month, and the fitting and wiring of H.M.S. *Sappho* and *Scylla* is nearing completion.

WELSH NOTES.

THE trade of the port at Cardiff has been extremely brisk in spite of the strike of the sailors belonging to Wilson's Union, directed chiefly against the Bute Docks. The coal and coke shipments of the port of Cardiff for the week ended Wednesday, February 18th, amounted to 266,893 tons, which quantity is not only the highest weekly total of the year's coal shipments, but is in addition 32,000 tons above the average of last year's weekly shipments. The coal, coke, and patent fuel shipments of the Bute Docks is considered to be very satisfactory.

The import trade of Swansea has been quiet, but the exports have been far above the average. Tinplates continue steady in tone and prices are well maintained. Makers are very actively employed turning out as many orders as they can between now and June, but fresh business transactions have been limited. The Harbour Trustees have completed the new warehouses for the storage of tinplates, which are equal to the storage of 100,000 boxes. In New York tinplates are again active, but prices are easier. In the metal market here the demand for consumption is steady. Copper has slightly improved.

An extension of the Victoria Tin-plate Works, Britain Ferry, was started last month. The engine, a very powerful one, came from Messrs. Galloway, Manchester. It has a high-pressure cylinder 26 in. diameter, and a low-pressure 46 in. by 4 ft. stroke. The fly-wheel was supplied by Messrs. Neville, Llanelly, and weighs 36 tons. The works now consist of six mills and sixteen tinning pots, and are equal to a make of 4,000 boxes weekly.

LEITH NOTES.

NOTHING of any interest has occurred in the shipbuilding or engineering trades since our last issue, and no new orders of any importance have been received here. A fair amount of repair work has been executed and all the local firms have prospects of a busy spring season. In the docks a large number of vessels were laid up at the beginning of the month, but over twenty of these have cleared out now and others are following every day.

It is expected that Messrs. S. & H. Morton & Co.'s yard will be carried on under the same name by two of the previous partners and an Edinburgh gentleman who is well known in engineering circles, but nothing definite has been settled yet.

The strike among the blast-furnacemen still continues, but the stocks on hand are so large and the demand so light, that prices, if anything, have a downward tendency.

Owing to the railway strike (now happily settled) having driven orders to the North of England ports, the price of coals from the Firth of Forth ports has also a downward tendency.

There has been no launch of importance on the Forth during the past four weeks, but, as a large amount of tonnage is near completion, launches will be numerous next month.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Blenheim.—On Tuesday, January 27th, Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer, built to the order of Messrs. Wilson & Corner, of Whitby. The vessel will take Lloyd's highest class. Her dimensions are—Length, over all, 295 ft.; breadth, 38 ft. 10 in.; depth, 22 ft. 10 in. The deck erections consist of a poop, raised quarter-deck, long bridge, and topgallant forecastle. The saloon and cabins are aft, the engine in a large deckhouse on the quarter-deck, and the crew's accommodation in the fore part of the bridge. The hull is built on the web-frame system with double-bottom under each hold for water-ballast. Large hatchways are fitted, four steam winches, steam steering gear amidships, screw gear aft, large donkey boiler, patent direct steam windlass and shifting boards throughout. Boats on beams overhead, two masts with schooner rig, and all modern working appliances will be fitted for general trading. The Central Marine Engine Works of W. Gray & Co., Limited, supply fine triple-expansion engines, having cylinders 22 in., 35 in., and 59 in. diam., with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The arrangements and building of the ship have been superintended by the late Captain G. B. Corner (one of the partners). The christening ceremony was gracefully performed by Mrs. Jones, of West Hartlepool, who named the steamer *Blenheim*.

Alton Tower.—On January 27th Messrs. Ropner & Son launched at Stockton a steel screw steamer of the following dimensions, viz.:—Length, over all, 324 ft.; breadth, 40 ft. 6 in.; and depth, moulded, 23 ft. 7 in. She will be classed A1 at Lloyd's, and carry 4,350 tons deadweight on Lloyd's summer freeboard. Her engines are by Messrs. Blair & Co., Limited, on their improved triple-expansion principle, of 1,200 I.H.P., with two large steel boilers, working at 160 lbs. The steamer has been built to the order of Mr. Charles Furness, of West Hartlepool, for Messrs. F. Stumore & Co., London, and was christened *Alton Tower*.

Feliciana.—On January 28th there was launched from the Palmer Co.'s shipyard at Jarrow a fine steel screw steamer of the following dimensions, viz.:—Length, between perpendiculars, 312 ft.; breadth, moulded, 41 ft.; depth, moulded, 23 ft. 1 in. The vessel has been built under special survey to class 100 A1 at Lloyd's, and will be rigged as a two-masted schooner, and has an iron main deck extending all fore and aft. The vessel is fitted with a long poop and bridge combined, extending to the foremast, and a topgallant forecastle. Accommodation for the captain, officers and engineers is fitted in an iron deck-house amidships on the bridge-deck, and the crew are accommodated in the forecastle forward. There is a double-bottom for water ballast, fitted throughout on the cellular system. The vessel will be completed with all the most modern improvements. The vessel on leaving the ways was christened the *Feliciana*, and has been built to the order of Messrs. McLean & Sutherland of Glasgow.

Rector and Weelsby.—On January 29th Earle's Co. launched at Hull two iron steam trawlers, built to the order of Mr. G. F. Sleight, of Grimsby, their dimensions being:—Length, 87 ft.; breadth, 20 ft.; depth, 10 ft. 6 in. The vessels are flush-decked and ketch-rigged, and are designed for inshore fishing. They are built to class 100 A at Lloyd's, and were named *Weelsby* and *Rector*.

Calvin.—On February 7th Messrs. C. S. Swan & Hunter launched from their west yard the steel screw steamer *Calvin* of the following dimensions:—Length, over all, 310 ft.; breadth, 40 ft.; depth, moulded, 23 ft.; classed 100 A1 at Lloyd's, built under special survey, and of the improved partial awning deck type, with full poop, long raised quarter-deck, long bridge-house extending forward of foremast, break forward and topgallant forecastle, water-ballast in a cellular double-bottom, steam winches, steam ring gear, steam windlass by Emerson, Walker & Co., ll modern appliances introduced. This is the eamer built by the same builders for Messrs. Arthur & Co., London. The engines are by the North- Marine Engineering Co., Limited, Wallsend, of the pansion type, and capable of indicating 1,250 H.P. As l left the ways she was named by Mrs. De Rusett, of uth.

Honresfeld.—On February 9th there was launched from the yard of Messrs. William Doxford & Sons, Limited, at Sunderland, what is said to be the largest sailing vessel yet built on the North-East Coast. The registered dimensions are:—Length, 312·90 ft.; breadth, 46·10 ft.; depth, 25·80 ft.; gross register, 3,070 tons. The vessel is built of steel to Lloyd's 100 A1 rules, and has four masts. The vessel is built to the order of Messrs. J. Joyce & Co., of Liverpool, and was christened the *Honresfeld*.

Agnes.—On February 10th there was launched by Messrs. R. Craggs & Sons, from the Castle Moat shipyard, Stockton, a steel steamer of the following dimensions:—Length, 173 ft.; breadth, 26 ft.; depth, moulded, 12 ft. 11 in. She will be fitted by Messrs. Westgarth, English & Co., Middlesbro', with triple-expansion engines, having cylinders 13 in., 21 in., and 34 in. by 24 in. stroke, and will be fitted with all the latest appliances for rapid loading and discharge of cargoes. She was named *Agnes* by Miss May Barugh.

Eiffel Tower.—On February 10th the steel screw steamer *Eiffel Tower* was launched from the building yard of Messrs. William Dobson & Co. Her dimensions are:—Length over all, 347 ft.; breadth, 40 ft. 3 in.; depth, 29 ft. 5 in. She will carry 4,500 tons deadweight, and will be fitted with triple-expansion engines having cylinders 23in., 31in., 61in. by 42-in. stroke, with large boilers.

City of Worcester.—On February 10th Messrs. Osbourne, Graham & Co. launched at Hylton, Sunderland, a steel screw steamer of the following dimensions:—Length, 290 ft. by 38 ft. beam by 22 ft. 6 in. depth, moulded. The vessel is built on the cellular system, and has a short poop, raised quarter-deck, long bridge, and topgallant forecastle, and will be fitted with tri-compound engines by the Central Marine Engine Works, of West Hartlepool, four powerful winches, direct steam windlass by Emerson, Walker & Co. and steam steering gear. As the vessel left the ways she was named the *City of Worcester* by Mrs. Bradley wife of the managing owner, Mr. George Bradley, of West Hartlepool.

Cygnus.—On February 10th a steamer was launched from the shipbuilding yard of Messrs. Wm. Thomas & Sons, of Almwch, to the order of Messrs. R. J. Francis & Co., of Liverpool. She was christened the *Cygnus*. Her dimensions are 147 ft. by 24 ft. by 12 ft., and she has a long raised quarter-deck, topgallant forecastle, and a spacious bridge-house, the latter being fitted for the accommodation of the master.

Ludgate.—On February 11th Messrs. Bartram, Haswell & Co. launched at Sunderland a large steel screw steamer for the Ludgate Steam Shipping Co., Limited, of Bishopsgate Street, London. The following are the principal dimensions:—Length, 290 ft.; breadth, 39 ft.; depth, 21 ft.; gross tonnage, 2,370 tons. She is of the raised quarter-deck type, with partial awning deck forward and poop aft, and has been built under special survey to take the highest class in Lloyd's Registry, and also under the superintendence of Captain Brown, of Liverpool. There is a water-ballast tank in each hold, and web frames and intercostals are fitted instead of hold beams. The deck machinery consists of four powerful steam winches, a large donkey boiler, patent combined steam and hand-steering gear amidships, horizontal screw gear aft, and patent steam windlass. The vessel will be schooner-rigged, with two telescopic steel masts, made to suit the Manchester Canal. The engines will be supplied by Messrs. Blair & Co., Limited, the cylinders being 22½ in., 36½ in., and 60 in.; stroke 39 in. She was named the *Ludgate* by Miss Smith, daughter of Henry Crawford Smith, Newcastle-on-Tyne.

Bramham.—On Thursday, February 12th. Messrs. W. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length, over all, 283 ft.; breadth, 38 ft.; depth, 20 ft. 1 in. She has been built to the order of the London and Northern Steamship Co., Limited (Messrs. Pyman Bros., London, managers), and will take Lloyd's highest class. The deck erections consist of poop, raised quarter-deck, long-bridge, and topgallant forecastle. A handsome saloon and accommodation for officers and a few passengers will be fitted up in the poop, and comfortable quarters for the crew in the fore part of the bridge. The hull is built with web-frames and a cellular double-bottom is fitted throughout. Large hatchways, large donkey boiler, four steam winches, steam steering gear amidships, screw gear aft, patent windlass by Emerson, Walker & Co., boats on beams overhead, and all modern appliances will be fitted. The engines are of the triple-expansion type, of 800 H.P., working on three cranks. They are supplied by the Central Marine Engine Works of W. Gray & Co., Limited. The cylinders are 20 in., 31½ in., and 53 in. diameter, and the piston stroke 36 in. The boilers, built of steel, are of large size and will give an ample supply of steam at a working pressure of 160 lbs. per square inch. The vessel has been superintended during construction by Capt. T. Pyman on behalf of the owners. The christening ceremony was gracefully performed by Mrs. Fry, of Cardiff, the vessel being named *Bramham*.

Sir Richard Grenville.—On Saturday, February 14th, Messrs. Laird Bros. launched from their works at Birkenhead an iron twin-screw steamer, built to the order of the Great Western Railway Co., and intended for service as a mail and passenger tender at Plymouth. As the vessel left the ways she was named *Sir Richard Grenville* by Mrs. Bevis. The owners were represented by Captain Squire T. S. Lecky, R.N.R., their marine superintendent, under whose direction the work is being carried out. The vessel has been specially designed for her intended service, and will have spacious deckhouse accommodation fitted with every comfort for passengers. She has been built to Lloyd's rules for their highest grade of classification, and is about 132 ft. long, by 30 ft. beam, with a tonnage of 545 tons o.m., and will be fitted with two sets of triple-compound engines driving twin screws. She will have a speed of about 12 knots, and will no doubt prove a very useful vessel for the service, as also for pleasure excursions, &c., for which she will be eminently suited.

Clan Macneil.—On February 14th there was launched from the yard of Messrs. Wm Doxford & Sons, Limited, Pallion, Sunderland, the first of the New Clan Liners being built to the order of Messrs. Cayzer, Irvine & Co., managers, Clan Line Steamers, Limited, Glasgow. Principal dimensions are: —Length, between perpendiculars, 312 ft.; breadth, extreme, 39 ft.; depth of hold, 23 ft. 6 in. To carry about 3,500 tons. Her engines are triple-expansion, the cylinders being 23 in., 37 in., and 62 in., by 42-in. stroke; the boilers are built for a working pressure of 180 lbs., and are fitted with Messrs. Howden's force-draft system and Emerson, Walker & Thomson Bros., Limited, steam capstan windlass. The christening ceremony was most gracefully performed by Miss Bella Lyall, daughter of the superintendent of the company.

Vista.—On February 16th there was launched by Messrs. W. White & Sons, at Cowes, a composite steam yacht, built to the order of Mr. Alfred Shuttleworth, who until recently owned the *Mera*. The principal dimensions of the vessel are:—Length over all, 112 ft. 6 in.; on water line, 91 ft. 6 in.; breadth, 14 ft. 6 in.; depth, 8 ft. 7 in.; and 93 tons yacht measurement. Her machinery consists of a pair of direct acting compound surface-condensing engines, with cylinders of 12 in. and 25 in., and a stroke of 18 in. The yacht has been built under special survey, and to class 20 years A1 at Lloyd's. She was named *Vista*.

Blodwen.—The three-masted schooner *Blodwen*, of about 220 tons deadweight, has been launched from the shipbuilding yard of Mr. David Jones, Portmadoc, built to the order of Messrs. Richards & Co., shipbrokers, Portmadoc, and Captain John Roberts, of Glanmeirion Talearnan.

Oscar.—On Saturday afternoon, February 21st, Sir Raylton Dixon & Co. launched from their No. 2 Dockyard a steel screw steamer, built to the order of Messrs. Potter Bros., London, for Messrs. Giovanni, G. Garguevitch & Giovanni Racich, of Ragusa. This vessel has been built on the web-frame principle, with raised quarter-deck, bridge and forecastle, and is of the following dimensions:—Length, over all, 243 ft. 9 in.; breadth, 34 ft. 6 in.; depth, moulded, 17 ft. 1 in. Her engines will be supplied by the North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 19 in., 30 in., and 49 in. by 33 in. On leaving the ways the vessel was named *Oscar*.

Ivanhoe.—On Monday, February 23rd, there was launched from the shipbuilding yard of Messrs. W. Harkess & Son, Middlesbro', a steamer built, under special survey and to Lloyd's highest class, of Siemens-Martin steel, of the following dimensions:—234 ft. by 34 ft. by 17 ft. 6 in., moulded. This vessel is of the raised quarter-deck type, with circular-fronted bridge amidships, for accommodation of captain and officers, long well, and topgallant forecastle for crew, web frames having clear holds, and extra large hatchways, making her a most suitable boat for timber, grain, or general trades requiring large cubical capacity, with facilities for the rapid loading and discharging of cargoes. All the most modern improvements in steamships of the highest class are on board, including steam steering gear, screw gear, large donkey boiler, steam winches and windlass, steam starting, reversing, and turning gear, cellular double bottom throughout for water-ballast, and provided with extra large pumps for quick discharge of same. She will be fitted with 128 H.P. engines of the tri-compound type, having cylinders 19 in., 28 in., and 47 in. with 33 in. stroke by Messrs. Alex. Shanks & Sons, and large steel boiler 14 ft. by 11 ft., 160 lbs. pressure, by Tyne Boiler Works Co., Limited, and is intended to carry 1,900 tons deadweight, on 16 ft. 10 in. draft, and steam nine knots on light consumption. On leaving the ways she was named *Ivanhoe* by Mrs. Bell.

LAUNCHES—Scotch.

Julia.—On January 27th Messrs. David J. Dunlop & Co., engineers and shipbuilders, Inch Works, Port-Glasgow, launched from their yard a handsomely-modelled awning-deck passenger steel screw steamer built by them to the order of Sebrines de Herrara, of Havana and Porto Rico. The dimensions of the new steamer are:—Length, 260 ft.; breadth, 36 ft.; depth, moulded to awning deck, 24 ft. 5½ in.; and about 1,800 tons gross. This new steamer has been constructed under Lloyd's special survey to their 100 A1 class in steel as an awning-deck vessel, with part shade deck. Accommodation for 40 first-class passengers is provided in a large deckhouse built on after-part of awning deck, and an elegant dining saloon is fitted in afterpart of this house, and the fore-part contains a recreation saloon. The second-class passenger accommodation is provided in a large deckhouse forward; and over this is placed a handsome teak deckhouse containing captain's cabin, chart and wheel house. The officers are accommodated in state rooms fitted up alongside boiler casings in midships, and the crew's accommodation forward. The entire space of the main deck from stem to stern is fitted up with cattle stalls for carrying cattle when necessary. The vessel will be fitted throughout with electric light, including a powerful search light; steam windlass, steam steering gear, hand steering gear, and three steam winches; steam capstan, and all other modern appliances for working the vessel. The engines, which are of the triple-expansion type, will be fitted by the builders, having cylinders 26½ in., 42 in., and 65 in. diameter, with a stroke of 3 ft. 6 in., supplied with steam from four large boilers, to enable the steamer to attain a high rate of speed. The ceremony of christening the steamer *Julia* was performed by Mrs. W. R. Cruickshank, Findhorn, Helensburgh. The construction of the *Julia* has been under the direct superintendence of Capitano Frederica Vintura, assisted by Senor Coira, the engineering superintendent for the owners.

Ryvingen.—On January 27th the Grangemouth Dockyard Co. launched from their yard at Kelliebank, Alloa, a steel screw steamer of the following dimensions:—Length, 165 ft.; breadth, 25 ft. 3 in.; and moulded depth, 13 ft. 7 in. The vessel, which is intended for the Mediterranean fish trade, has been built to the order of Messrs. Yensinenich & Co., Christiania, and is fitted up with all the latest improvements. As it left the ways the steamer was christened *Ryvingen* by Miss Maggie Bain, daughter of the manager of the company.

Lightning.—On January 28th there was launched from the shipbuilding yard of Messrs. D. & W. Henderson & Co., Meadowside, Partick, the *Lightning*, a handsomely-modelled screw steamer of 3,250 tons, built to the order of Messrs. Apcar & Co., Calcutta. The vessel, which is intended for the trade between Calcutta and China, has been constructed in accordance with Lloyd's requirements for the 100 A1 three-deck class. Her dimensions are:—Length, 352 ft.; breadth, 42 ft. 9 in.; depth, 28 ft. 9 in. The hull is of iron, with a double bottom fore and aft for water ballast. In an iron deckhouse and poop situated aft, accommodation has been provided for about 20 first-class passengers. Under the bridge-deck amidships, where the officers' and engineers' quarters are, accommodation has been provided for a limited number of second-class passengers. The seamen and firemen will be berthed forward under the upper deck. The vessel will be lighted throughout by electricity. All the latest appliances for the rapid handling of cargo and the navigation of the ship have been supplied. Clarke, Chapman & Co.'s steam windlass has been fitted forward, Davis & Co.'s steam-steering gear amidships, and Hastie's screw-steering gear aft. The bottom of the vessel was coated a day or two before the launch with Hartmann's Rahtjen's composition.

Triple-expansion engines with cylinders of 27½ in., 44 in., and 71½ in. diameter, and a stroke of 54 in. will be supplied by the builders. The hull and engines have been constructed under the superintendence of Captain H. de Smidt and Mr. Graham.

Ptarmigan.—On January 28th a steamer named the *Ptarmigan* was launched from the yard of Messrs. Gourlay Bros. & Co., Dundee. The *Ptarmigan*, which has been built to the order of the General Steam Navigation Co., London, is constructed of steel, and is of the following dimensions:—Length, 220 ft.; breadth, 30 ft. 6 in.; depth, moulded, 15 ft. 6 in.; and her gross tonnage is about 1,000 tons. The vessel is built on the cellular double-bottom principle, and has specially large hatches, while her fittings include steam steering gear, steam windlass by Emerson, Walker & Co., and four steam cranes for the rapid handling of the cargo.

Sheik Berkhud.—On February 9th Messrs. Scott & Co., Greenock, launched a steel screw steamer of 400 tons, named *Sheik Berkhud*, for the Perim Coal Co., for service on the Red Sea. The builders will supply triple-expansion engines of 500 I.H.P.

Weimar.—On February 9th the Fairfield Shipbuilding and Engineering Co., Limited, launched from their yard at Govan the *Weimar*, a steel screw steamer of 5,400 tons, built to the order of the Norddeutscher Lloyd of Bremen. Her dimensions are—Length, over all, 430 ft. 10 in.; breadth, moulded, 48 ft.; depth, moulded, 33 ft. The vessel has been constructed in accordance with the latest regulations of the Germanischer Lloyd, under their special survey, and will be classed in the highest grade of that society. The hull is of Siemens-Martin steel. The ship will have accommodation for about 42 first-class, 36 second-class, and 2,100 third-class passengers, besides ample accommodation for officers and crew. The vessel will be lighted throughout by electricity, provided by three engines and dynamos, each furnishing power for 365 incandescent lights. Her engines are of the inverted triple-expansion type, with cylinders 31 in., 52 in., and 83 in. dia., and a stroke of 4 ft. 6 in. Steam will be supplied by two double-ended and two single-ended boilers, each of steel. The boilers have been constructed for a working pressure of 150 lbs. per square inch, and her hull is coated with Hartmann's Rahtjen's composition.

Centurion.—On February 11th Messrs. Russell & Co. launched from their Greenock yard a four-masted steel ship of the following dimensions:—Length, 256 ft.; breadth, 39 ft.; and depth, 22 ft. 9 in. Her nett register is 1,700 tons, with a carrying capacity of 2,850 tons. She was named *Centurion*, her owners being Messrs. G. T. Soley & Co., Liverpool.

Gowanbank.—On February 12th Messrs. Russell & Co. launched from their Kingston yard, Port-Glasgow, a four-masted steel sailing barque to the order of Messrs. Andrew Weir & Co., Glasgow. Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 3 in.; about 2,200 tons register, capable of carrying 3,600 tons deadweight on Lloyd's freeboard. This vessel was built under the superintendence of Mr. James Stewart, marine surveyor, Glasgow, and will complete her outfit in the James Watt Dock, Greenock.

Goval.—On February 12th a steel screw steamer named the *Goval* was launched by Messrs. Hall, Russell & Co., at Aberdeen. The vessel has been built for Messrs. William Leslie & Co., Aberdeen. The dimensions of the *Goval* are:—Length, over all, 168 ft.; breadth, 24 ft.; depth, 12 ft. 6 in; and about 470 tons gross register. The vessel has been built under special survey to class 100 A at Lloyd's, and will be fitted with triple-expansion engines.

Baroda.—On February 12th Messrs. Archibald M'Millan & Son, Limited, launched at Dumbarton a steel sailing barque of 1,400 tons register and 2,425 tons deadweight capacity, for Messrs. W. & J. Crawford, of Greenock. The vessel, which was named *Baroda*, is to load on the Glasgow berth for Sydney.

Premier.—On February 13th Messrs. S. M'Knight & Co., shipbuilders, Ayr, launched from their yard a steel screw steamer, named *Premier*. Dimensions:—Length, b.p., 155 ft.; breadth, 23 ft.; depth of hold, 10 ft. She has been built under special survey to class 100 A1 in Lloyd's register, and has a raised quarter-deck extending to the machinery space, a bridge deck over engines, boiler, saloon and state rooms, and long top-gallant forecastle, forming a shelter for deck passengers, also opening gangways in both sides of bulwarks opposite each hatchway. The vessel is handsomely fitted up below the bridge with state rooms, dining saloon, and ladies cabin to accommodate 30 first-class passengers; a house, of teak, on bridge deck, comprising companion and wheel house, with pilot bridge over same; and a house on quarter-deck, with internal fittings of polished hardwood for a smoking-room. Accommodation for engineers and officers is under the aft end of bridge deck, and crew forward under the forecastle. The engines are compound surface-condensing, and will be supplied by William Kemp, Govan. Cylinders, 22 and 44 in. diameter, by 30 in. stroke; boiler, 13 ft. diameter, by 10 ft. 6 in. long, 100 lbs. w.p. The vessel will also have two steam winches and a donkey boiler. This steamer has been built to the order of Mr. Joseph Wood, Halifax, N.S., and is designed to attain a high rate of speed.

Norway.—On February 13th the Grangemouth Dockyard Co. launched from their shipbuilding yard at Grangemouth a handsomely-modelled steel screw steamer, named *Norway*, of the following dimensions:—Length, 211 ft. by 29 ft. by 20½ ft. to spar deck and 13½ ft. hold to main deck. The vessel is built to the order of Messrs. Jens Meinich & Co., of Christiania, and is being handsomely fitted up for a large number of first, second, and third class passengers. The engines are being constructed and fitted on board by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow, and a high rate of speed is expected. All the latest improvements for working ship and cargo have been introduced, including Clarke, Chapman's steam windlass, Alley & M'Lellan's steam steering gear, &c. The *Norway* is intended for the owners' passenger and cargo route between Christiania and Grangemouth, and is a sister vessel to the s.s. *Scotland*, also built by the Dockyard Co., and now plying between Christiania and Grangemouth.

LAUNCHES—Irish.

Silverstream.—On January 29th Mr. C. J. Bigger launched, at Londonderry, a steel barque of the following dimensions:—Length, 220·6 ft.; breadth, 30·3 ft.; depth of hold, 21·9 ft. She was christened the *Silverstream*. The *Silverstream* is built to the order of a firm of Belfast shipowners for their Portland (Oregon) trade. She will carry 1,950 tons deadweight, and her register tonnage will be about 1,160 tons.

Nomadic.—On February 11th there was launched from the shipyard of Messrs. Harland & Wolff, Belfast, another addition to the already long list of steamers which this eminent firm have built for the White Star Line. The *Nomadic*, as this vessel is called, is the first of two steamers now in course of construction, and will be followed by the *Tauric*, which is expected to be launched about the middle of March. The dimensions of these vessels are:—Length, 460 ft.; breadth, 49 ft.; depth, 35 ft. Their register tonnage will be about 5,750 tons respectively, and, like their greater predecessors, the *Teutonic* and *Majestic*, they will be propelled by twin screws. The satisfactory experience gained in the *Cufic* and *Runic*, which, during the time they have been engaged in the trade, have landed 19,097 cattle safely, and only lost 121, or 63-100ths of one per cent., all losses being due to sickness, none to stress of weather, has been availed of in the present instance, and both these steamers are being specially built with a view to the carriage of cargo and cattle. The utmost care has been bestowed in the arrangement of fittings and ventilation, and in the cattlemen's quarters, and it is hoped that good as the record of the White Star steamers now is in respect of the safe carriage of cattle it may be equalled and even surpassed when the *Nomadic* and *Tauric* get fairly to work.

Ramore Head.—On Monday morning, February 9th Messrs. Workman, Clark & Co., launched the fine steel screw steamer named the *Ramore Head*, built to the order of the Ulster Steamship Co., being the third steamer built by Messrs. Workman, Clark & Co., for the same owners. The dimensions of the vessel are:—Length, between perpendiculars, 401 ft. 9 in.; breadth, moulded, 44 ft. 6 in.; depth, to Lloyd's floors, 29 ft. 4 in.; about 4,000 tons gross register, and carrying capacity of about 6,500 tons. The steamer has been constructed under the supervision of the company's officials, and will be classed 100 A1 at Lloyd's, under special survey, and with machinery certificate. The vessel is built under the three-deck rule, with long forecastle, long bridge-house amidships, extending from side to side of the vessel, forming a complete protection for engine and boiler casings, &c.; short half-poop, and large iron wheelhouse aft. The upper deck is fitted with very substantial iron rails and stanchions, and solid bulwarks, powerful steam winches, steam windlass, capstan, and steering gear. The *Ramore Head* is built on the cellular-bottom principle, having capacity for about 850 tons water ballast with large trimming tank aft, fitted for cargo; is schooner-rigged, with two steel pole masts; has two heavy steel decks and bridge deck of teak, and accommodation for a few passengers amidships in the bridge-house. The saloon is handsomely fitted in polished light oak, upholstered with morocco leather. Large teak chart-house on bridge, with wheelhouse above on flying-bridge. Crew are comfortably housed under topgallant forecastle. The steamer is fitted throughout with a complete installation of electric light. The engines are by Messrs. John & James Thomson, Glasgow, and are of the triple-expansion type, with cylinders 26½ in., 44 in., and 72 in. diameter, and 4 ft. 3 in. stroke, to indicate about 2,250 H.P., with 170 lbs. working pressure; steel shafting and manganese bronze propeller. Steam is supplied from two large multitubular double-ended steel boilers, with six furnaces in each, tested to a pressure of 340 lbs., and fitted with all recent appliances, including combined evaporator and feed-water heater, with internal boiler heaters and circulators, zinc receivers, and air and oil extractors. The *Ramore Head* is the largest Irish owned and built steamship, and a fine specimen of the most modern type of cargo steamer. She will be commanded by Captain Thomas M'Calmont, commodore of the Head Line, who has been connected with the company since its formation. The Ulster Steamship Co. now owns a fleet of nine high-class cargo steamers, of which eight have been built in Belfast.

TRIAL TRIPS.

Heighington.—On January 27th the fine new steamer *Heighington*, built by Messrs. William Gray & Co., Limited, to the order of the Hudson Shipping Co., West Hartlepool, went on her trial trip in Hartlepool Bay. The vessel is 324 ft. long over all, 40 ft. 6 in. beam, and 23 ft. 8½ in. in depth, moulded, having a deadweight capacity of 4,350 tons, and is classed 100 A1 at Lloyd's. The engines are supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., and are of the triple-expansion type of 1,200 I.H.P., having two large steel boilers working at a pressure of 160 lbs. The vessel had on board about 700 tons of bunker coals for her voyage to America and back. She proceeded to sea about four o'clock, and as soon as daylight arrived she was manœuvred to suit the adjustment of compasses, and subsequently the engines were run till about 1 p.m., at a speed of 75 revolutions per minute, the log being put overboard, when it was found the vessel was running a little over 11 knots per hour. Everything ran perfectly well, there being no signs of heating or trouble of any kind, the performance of the vessel and engines being highly praised both by Capt. Blacklin, the manager of the Hudson Shipping Co., and Mr. Airey, the superintending engineer. After the toast of "Success to the *Heighington* and her Owners" had been proposed by Mr. Mudd, who represented the engine builders, and responded to by Capt. Blacklin, the trial trip party left the vessel by tugboat, and she at once proceeded on her voyage to Norfolk (U.S.A.) to load cotton for home.

Dunbeth.—On January 27th the s.s. *Dunbeth*, built by Messrs. Craig, Taylor & Co., Stockton-on-Tees, to the order of Messrs. Macbeth & Gray, Glasgow, and under the superintendence of Mr. J. Donaldson, consulting engineer, of 75, Jamaica Street, Glasgow, ran her trial trip from Leith, where the vessel was completed, and which proved very satisfactory. The dimensions of the vessel are as follows:—300 ft. by 37 ft. 9 in. by 21 ft. 9 in. She is built on the web-frame and cellular-bottom principle, with half-poop, raised quarter-deck, long-bridge and topgallant forecastle. She has steam windlass by Emerson, Walker & Thomson Bros., outfit of winches by Clarke, Chapman & Co. steam steering gear by Alley & Maclellan, and all modern improvements so as to admit of rapid loading and discharging. Her engines, on the triple-expansion surface condensing system, are by Messrs. Dunsmuir & Jackson, Govan, Glasgow, with cylinders, 22 in., 34 in., and 56 in. by 39 in. stroke. She steamed under the Forth Bridge, and on a run of nearly 20 miles a mean speed of close on 11 knots was obtained.

Iris.—On January 27th the handsome twin-screw steamer *Iris*, built and engined by Messrs. Blackwood & Gordon, Port-Glasgow, for Messrs. Hill, Gomes & Co., Manchester, went down the Firth on her official trial trip. The speed was tested on a double run between the Cloch and Cumbrae lights, when a mean speed of fully 13 knots was attained with the tide against the vessel on both of the runs, which was considered highly satisfactory—being at least a knot beyond the guaranteed rate. This steamer has a tonnage of 1,430 tons, is built to the highest class at Lloyd's, with teak decks, and is fitted with a large and highly finished saloon, in which the comfort of passengers has been carefully studied, the sleeping cabins being large and airy, and replete with all the modern fittings and furnishings. She is also fitted with steam windlass, Wallace's steam steering gear (having Campbell & McCullum's patent worm wheel), steam cranes and winches, and all the necessary equipment for the speedy handling of general cargo. The engines, also constructed by Messrs. Blackwood & Gordon, are of the triple-expansion type, with large boiler power. The valve gear is Morton's patent (which allows of the length of machinery space being considerably reduced), and all the other fittings and connections are of the most improved type. The company, invited by the builders, joined the vessel at Gourock, and, as the day fortunately was all that could be desired in the matter of weather, a most enjoyable trip was the result.

Tyne.—On January 28th the new steel screw steamer *Tyne*, built by Messrs. Ramage & Ferguson, Leith, for the Royal Mail Steam Packet Co., of London and Southampton, went out for her preliminary trial on the Firth of Forth. Although a very strong wind was blowing during the trial the results of several double runs on the measured mile showed a mean speed considerably over the contract limit, and the engines throughout worked without a hitch. The *Tyne* has been built especially for the intercolonial West Indian service of the Royal Mail Co., and will have her headquarters at the island of Antigua. Her passenger accommodation is entirely on deck, and comprises saloon and governor's cabins forward, while abaft this is entirely occupied by first-class passengers' state rooms, which are fitted up in a most complete and sumptuous manner.

Pickhuben.—On January 29th the new steel screw steamer *Pickhuben*, built by Messrs Barclay, Curle & Co., Limited, for the Dampfschiff-Rhederei Hansa, Hamburg, to trade between the latter port and Montreal, was tried for speed on the Clyde. Her dimensions are 330 ft. by 41 ft. 3 in. by 29 ft. 9 in., and has been built to the highest class at Lloyd's Register and in the Bureau Veritas spar-deck rule. She is built to carry a large cargo on a light draught and to steam about 10 knots at sea. She is also adapted to carry live cattle, the arrangements for ventilating, feeding, and shipping them being of the most complete description. She has triple-expansion machinery and patent blowing engines for ventilating cargo holds and 'tween decks On running between the Cloch and Cumbrae lights she attained a mean speed of 12½ knots against the tide both ways. Everything worked most satisfactorily, and to the entire satisfaction of the owners' representatives.

Patagonia.—On February 5th the steamer *Patagonia*, belonging to the fleet of the Pacific Steam Navigation Co., of Liverpool, which has just been refitted by the Naval Construction and Armaments Co., Limited, at Barrow, with a new set of triple-expansion engines, went out for her trial trip of 130 miles, when the new machinery worked with the utmost satisfaction.

Rio Formoso.—On February 10th the new twin-screw steamer *Rio Formoso*, which has been built by Messrs. Wigham Richardson, of the Neptune Works, Low Walker, to the order of Mr. William Blackburn, of Liverpool, representing the Companhia Pernambucana of Pernambuco, went for a very successful trial trip off the mouth of the river. The vessel is built of steel, under special survey, to class 100 A1 in Lloyd's Register, and is rigged as a schooner, with two polemasts. The engines have also been constructed by Messrs. Wigham Richardson & Co., and are on the triple-expansion principle, of their well-known type, and are suitable for driving the vessel at a good speed in shallow water. On the trial trip they worked without the slightest hitch, and gave universal satisfaction. Mr. Blackburn, of Liverpool, the representative of the Companhia Pernambucana, and Mr. H. F. Moore, of Liverpool, under whose superintendence the steamer has been constructed, were on board, and expressed themselves as thoroughly satisfied with the vessel.

Cereda.—On February 10th the new steel screw steamer *Cereda* proceeded to sea on her trial trip. She has been built by Messrs. John Readhead & Sons, West Dock, South Shields, to the order of Messrs. Cay, Hall & Partners, Limited, of Newcastle-on-Tyne. Her principal dimensions are as follows, viz.:—290 ft. by 40·6 ft. by 22·3 ft. moulded, and she is of the improved well-deck type, having poop, raised quarter-deck, long extended bridge, and topgallant forecastle. She is classed 100 A 1 at Lloyd's under special survey, has steam steering gear, direct-acting steam windlass, and every appliance for securing efficient and economical working. She is also fitted with shifting boards and bulkheads according to Grain Cargoes Act, and will carry 3,800 tons on a light draught of water. The vessel is fitted with triple-expansion engines (also built by Messrs. J. Readhead & Sons), having cylinders 23 in., 37½ in., 61½ in. by 39-in. stroke, which are supplied with steam from two large steel boilers, having a working pressure of 160 lbs. On the trial everything worked with the greatest smoothness, the results being completely satisfactory to all concerned. There was a very large company present, including the builders and owners. The vessel and machinery have been built under the superintendence of Mr. Arthur Cay, son of the managing owner.

Taurus.—Early on Saturday morning, February 14th, the fine screw steamer *Taurus*, built by Messrs. Wm. Gray & Co., Limited, to the order of Mr. Wilhelm Wilhelmsen, of Tonsberg, Norway, went on her trial trip. The dimensions of the vessel are:—Length, over all, 288 ft.; breadth, 37 ft. 2 in.; depth, 21 ft. 2 in. The engines, which are of the triple-expansion type, have been supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., the cylinders being 21½ in., 34 in., and 57 in. in diameter, with a piston stroke of 39 in. Steam is supplied by two large steel boilers working at a pressure of 160 lbs. The vessel takes Lloyd's highest class, and is altogether fitted out in the best style as a cargo boat, with all the latest improvements, including a "Yaryan" evaporator. After adjustment of compasses, a run was made to sea for above an hour at full speed, the engines making upwards of 90 revolutions per minute during that time, and a speed of 12¼ knots being maintained. The owner was represented by Mr. Buckle, of the firm of Messrs. George Noble & Buckle, Newcastle-on-Tyne, under whose superintendence the ship and machinery have been constructed. Mr. Thomas Mudd represented the builders and engineers. Everything worked in the most satisfactory manner, and the representatives of the owner expressed themselves as highly pleased with the result. On the conclusion of the trial the steamer proceeded on her voyage to Cardiff to load for the River Plate.

Justin.—On February 16th the s.s. *Justin*, a steel screw steamer built for Messrs. Arthur Holland & Co., London, by Sir Raylton Dixon & Co., Middlesbro', took her trial trip from the Tees. This vessel is built on the web-frame principle, with poop, raised quarter-deck, bridge and topgallant forecastle. Her leading dimensions are:—Length, over all, 287 ft.; breadth, 39 ft.; depth, moulded, 21 ft. 3 in., with a deadweight capacity of about 3,300 tons at 19 ft. 7 in. Her engines were supplied by Messrs. Blair & Co., Stockton, Limited, having cylinders 21 in., 35 in., and 57 in. by 39-in. stroke, which gave every satisfaction.

Fuping.—On February 16th the handsome steel screw passenger steamer *Fuping*, built at Blyth by the Blyth Shipbuilding Co., Limited, for Mr. James Whittall, of London, per Mr. John White, also of London, for China trading, had a highly satisfactory trial trip. The *Fuping* is a duplicate of the *Ching Ping*, recently built for Mr. John White, and is 223 ft. in length, has full poop for passengers and ample accommodation amidships, teak decks, Smith & Sons' steam winches, Doukin & Nichol's steam-steering gear, Napier's patent windlass and capstan, and the cabins are upholstered by Hedley & Co., of Blyth. The vessel left the River Blyth during the forenoon with a party of gentlemen on board, when she had a series of runs along the coast, with results very highly satisfactory to all interested. The *Fuping* was then taken into the River Tyne, where she will load a cargo of machinery at Newcastle Quay for China, and be commanded by Captain Sharman. This is probably the first cargo of machinery shipped direct to China from Newcastle Quay. The engines are by Mr. Middleton Pratt, of Huddersfield, and are of the triple-expansion type, and worked with great smoothness and efficiency. The whole of the work has been carried out under the superintendence of Mr. J. G. Walton, of London, who is also superintending the building of a larger vessel by the company for China.

Barham.—On February 17th the *Barham*, built and engined by Messrs. Hawthorn & Co., Newcastle, went out of Portsmouth harbour for an eight hours' trial of her machinery under natural draught. Since her former mishaps she has had the nests of tubes in her boilers somewhat depleted, and the consequent freer circulation of the water enabled her successfully to complete her trials. The vessel was down to her load-line, her trim forward being 11 ft. 9 in.; aft, 14 ft. 9 in. The boiler pressure was 139 lbs.; the revolutions were 175¼, and the mean vacuum in the condensers was 26½ in. Under these conditions the starboard engine developed 1,760, and the port engine 1,854 horses, thereby giving a collective H.P. of 3,614, or slightly over the contract, with 1 in. of air pressure in the stokeholds. The mean speed realised was 17·348 knots. The results of the trial will be considered sufficient to justify the Admiralty in taking over the ship, as it is not intended to press her under forced draught with her present boilers.

Blanche.—On February 18th this cruiser underwent a three hours' trial with natural draught, off Plymouth, with satisfactory results. The boiler pressure was 163 lbs.; the revolutions were 161, and the mean vacuum in the condensers was 25·5 in. The H.P. developed under these conditions was 1,700, with an air pressure of 0·3 in., the speed attained being 15 knots.

Holkar.—On February 18th this large and well-powered steamer, which has been built to the order of Messrs. George Tweedy & Co., of London and Odessa, by Messrs. Wigham Richardson & Co., of the Neptune Works, Newcastle-on-Tyne, was taken to sea for her trial trip. Several gentlemen, who are friends of the managing owners, were present, including Mr. E. Ecroyd, of Armathwaite, Messrs. T. B. and B. F. Ecroyd, Mr. Isaac Grant, Mr. George Richardson, Mr. Heskett, of Penrith, Mr. Webster, of Odessa, as was also Mr. George Tweedy, of Messrs. George Tweedy & Co., Mr. de Winton, consulting engineer, of Liverpool, under whose superintendence the vessel has been built, and Mr. Christie, of the builders' firm. The vessel is fitted with the builders' patent four-crank quadruple-expansion engines, and during the series of trials that she was put to the most satisfactory results were obtained, the mean speed being 12 knots. The trial generally fully justified the confidence which the owners and builders have in these engines, based on the results obtained from two similar sets of the patent four-crank quadruples, which have now been running a considerable time, in the sister vessels, the *Enskar* and the *Fonar*. The *Holkar* is intended to run in conjunction with the two latter vessels in the North Atlantic Line between London and Philadelphia. The *Enskar* and *Fonar* have already earned a high reputation in the cattle trade for carrying their cargoes of cattle without loss, and it is expected that the *Holkar* will not only maintain that reputation, but will give a specially good account of herself, as the owners have spared no expense to make her one of the most complete cattle steamers afloat. She is arranged so as to carry about 600 head of cattle on her two decks; the 'tween deck is amply ventilated by numerous air shafts of large diameter, while the cattle on the upper deck are berthed in suitable stalls and protected from the weather by permanent shelter deck, which extend right fore and aft, thus affording complete protection from the worst seas she may encounter. As already stated, the engines of the *Holkar*, like the *Enskar* and *Fonar*, are of the four-crank quadruple-expansion principle, which has been patented by the builders, and after upwards of 18 months' trial at sea on regular voyages, have given great satisfaction as to economy of fuel, efficiency of working, &c., important features in them being the facility they give for inspection and overhauling, the entire absence of vibration, and the absolute uniformity of turning. After a most satisfactory day the vessel returned to the Tyne to disembark her visitors, and then proceeded on her voyage.

A NOVEL ICEBREAKER.—Two Norwegian engineers have constructed a model for an icebreaker or, as they term the vessel, "fjord opener," on an entirely novel principle. Instead of the ice being broken as now by ramming, it is sawn through by circular saws working from the bow below the ice, which, by a supplementary arrangement, is thrown out of the channel cut in the ice, instead of, as at present, left to endanger the safety of, or obstruct vessels. In northern latitudes such a vessel would be invaluable, and one on this principle is to be built in Christiania.

Reviews.

Surveying and Levelling Ins'ruments. By W. F. Stanley. London: E. & F. N. Spon. 1890.

This is the first edition of a work which will be welcomed by many who carry out surveys, whether on land or sea. It will also be of interest to the ordinary navigating officer who desires to know something about the nice points of the instruments which are of daily use to him. From Mr. Stanley's long experience as a maker we anticipate this will become the text-book on the subject. The volume is of a handy size, and runs through sixteeen chapters. The system of numbered short paragraphs is adopted, the paragraphs being grouped where necessary under one heading. These last are printed in larger type, and are therefore easily distinguished. Perhaps it is rather with the design of special instruments that the average reader is most concerned, we therefore pass over the description given of the mode of manufacture, as very few are likely to take up this for themselves. The lubrication, preservation, and packing away of instruments, however, claim attention. Pure vaseline is recommended for the first, and as regards protection in tropical climates it is said to be better to cover the ordinary mahogany case with solid leather to withstand blows and other effects of hard usage. The telescope, being the fundamental part of almost every instrument, is taken first, and has a chapter devoted to it. We find refraction and reflection treated in its various phases graphically, as also the other parts embraced by this detail, viz.:—the lens, the eye-piece, the diaphragm, &c. The qualities of a telescope are correctly stated to be estimated by its performance. A test is to place a staff at a range of 10 to 15 chains and see if the ·01 foot is read clearly in fine bright weather. More refined tests still are furnished likewise.

To sailors the third chapter will be of value, as the compass is here dealt with. The information given is very full indeed, commencing with the manufacture and magnetisation of the needle, treating of the errors connected with it, and showing how to retain its properties. When put by out of use the needle should not be allowed to remain out of its bearings. Cleanliness is also strongly enjoined for obvious reasons. The question of levels is introduced by the general definition of a true horizontal plane "as the open upper surface of a liquid unaffected by currents of air, or the influence of solid objects in close proximity to cause capillary action or the local attraction of solid masses." We are told also that the sensitiveness of the bubble in level tubes depends on the mobility of the liquid and the power of adhesion between it and the glass of the tube. Taking water as 100, the relative mobility of chloroform is 3, and methylic alcohol 22. The latter is generally selected for the purpose, owing to its cheapness, while the former is rarely employed because of its expansion under heat and consequent liability to burst its tube. Several pages are devoted to the many kinds of surveyors' levels. All these are well illustrated; that known as the "Dumpy Level" seems to be in general use now. The importance of adjustments is not neglected, and the directions are very complete for preserving truth under the trying conditions to which instruments in general are exposed. We leave the chapter on levelling staves and the usual practice that obtains in levelling a tract of country and tabulating the results. Small items like an "Excise Ink Bottle" are shown and recommended as being portable in the field. The part of the subject that has to do with marking the instruments is interesting. The dividing engine which cuts the graduations is not illustrated, and the description therefore cannot be so well followed. This operation is an important one, as if the cuts are not uniformly deep the divisions would appear uneven and the readings become difficult to follow. The principle of the vernier is explained very clearly, as also the micrometer for specially exact work. In any book on surveying instruments a principal place must be given to the leading instrument, the theodolite. Nothing appears to be omitted to make this chapter a faultless one.

In the purely marine portion of the volume we find quadrants, sextants, &c., filling about fifty pages. The former may be left alone, and for those who do not understand the basis on which the latter is constructed there is a diagram showing how a double angle is measured by a single movement of the vernier arm. The adjustment arrangement of the horizon glass is closely gone into in a manner that will commend itself to users, and which should enable many to remedy any errors for themselves. The adjustments of the index glass and of the telescope are also mentioned. Artificial horizon comes in for attention as well as other forms of sextant like the sounding and the box kinds. This latter is like the ordinary nautical one, but covered up, affording a protection to every part. It is greatly in vogue for land surveys for the above reasons.

From want of space we are unable to follow the author to any greater length. We can only say that civil engineers, military and naval officers are sure to find what they want when any knotty point connected with surveying instruments comes in their way, and from the standing of the author alone it will be gathered that the work is a *resumé* of current English practice in this particular branch.

Correspondence.

It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

ELECTRIC LIGHTING ON BOARD SHIP.

To the Editor of The Marine Engineer.

Dear Sir,—In your current number there appears an interesting account of the early history of electric lighting on board ship. I think that though the Inman line was the first to adopt this mode of lighting of the lines running to New York, you will find by reference to your own issue of December 1879 that the *Mendoza*, a new Pacific Steam Navigation Co.'s vessel, was absolutely the first ocean steamship thus equipped.

The *City of Berlin*, I believe, did not try electric lighting till January 1880.

As your magazine is such a standard work for reference, I think it right to call your attention to this matter, so that the credit of introducing this illuminant, which is now considered an every-day necessity at sea, may be given to those to whom it is due.

Apologising for troubling you,
I am, yours obediently,
Feb. 10th, 1891. B. W. G.

[Our correspondent is quite right about the *Mendoza*, but as that vessel was only furnished with an old simple Gramme machine and service lamp that had already done service in the Messrs. Napier's boiler shop, it turned out somewhat of a failure, while in the case of the *City of Berlin*, the original installation ran for years, in fact till the whole incandescent installation was put into the ship.—Ed., M.E]

Miscellaneous.

"Pallas."—The second-class cruiser *Pallas*, built at Portsmouth and engined by Messrs. Hawthorn, Leslie & Co., of Newcastle, made a very successful full-power trial on Friday under natural draught.

New Line of Steamers.—A new company has been formed in Liverpool to continue the service from that port to North Wales, and an order has been placed with the Fairfield Shipbuilding and Engineering Co., Limited, for a new boat of 19 knots speed. The name of the new company is the Liverpool and North Wales Steamship Co., and the capital is £65,000.

A New Sensation.—*Iron* says:—"Amongst all the wild ideas which have emanated from the fertile brain of man that of M. Aristide Bergès, a French engineer, is about the wildest. His Invention is to form one of the attractions of the Chicago Exhibition. He proposes the construction of another Eiffel Tower, from which those asking for new sensations are to be dropped in a car. He estimates that at the end of a drop of, say, 1,000 ft., the velocity is more than double that of the fastest train. The chief point is to receive the passengers safe and sound at the end of their journey through space. M. Bergès gives the car the form of a projectile, which he drops into a sufficiently deep well of water. His car is to be capable of holding 15 passengers, and its interiot dimensions are 10 ft. by 13 ft., the floor resting on springs. The lower part consists of a series of cones, in order to prevent the compression of the air in the chamber when the projectile drops into the water. Its total weight is 11 tons, and its displacement 31 tons. For a drop of a little over 1,000 ft., the depth of the water in the well would be 180 ft. We may add that the designer of this novel plan proposes to fasten the passengers down in their seats."

Civil and Mechanical Engineers' Society.—At a meeting of this society held at the Westminster Palace Hotel a paper was read by Mr. Horatio Daniell on "The Jerome Steamship Shaft." In the course of his paper Mr. Daniell maintained that in this shaft great increase of strength was combined with flexibility; that the experiments made had shown promise of great results; and that absolute dependence could be placed upon such shafting. The advantages shown of this over solid shafting were that the deadweight was little over half, cost was saved, and the tortional strength was increased 13 times. The shaft being of steel rods or wires (affording both torsional and transverse elasticity), flaws were more easily detected than in forged shaft, where there was no absolute security against imperfections. Whatever the surface demanded of it, every part and fibre of a Jerome shaft bore its exact proportion of strain. The discussion was opened by the president, Mr. R. Nelson Boyd, and he was followed by Professor Henry Adams, Mr. Benjamin Haughton, Mr. J. H. Turner, and Mr. W. Lee Beardmore. A vote of thanks was given to Mr. Daniell for his paper.

New Atlantic Steamer.—The *Havel*, a screw steamer of 9,000 tons register and 14,000 H.P., the latest addition to the fleet of the Norddeutcher Lloyd, has been placed by her owners on the Bremen, Southampton, and New York line. She has been built by the Vulcan Co. at Stettin, on the one-screw system. The engines are triple-expansion, the high-pressure cylinder 38 in. diameter, the intermediate pressure 75, and the low-pressure 100, each of which is adapted for a stroke of 6 ft. Steam is supplied from ten boilers, of which six are double-ended and four single-ended. Each boiler is 15½ ft. in diameter; the length of those double-ended 18 ft. 8 in., and of the single-ended 10 ft. 4 in. The boilers are constructed entirely of steel, and are adapted for a working pressure of 11 atmospheres. The propeller has four blades of manganese bronze, the diameter of the screw being 21 ft. 7 in., and its pitch 31 ft. 4 in. The *Havel* is rigged with three pole-masts of steel, without yards. She is 485 ft. long, 52 ft. beam, and 38 ft. deep, moulded, and has accommodation for 244 passengers in the first saloon, 122 in the second, 460 third-class passengers, and officers and crew to the number of 240. The saloon, a very spacious apartment, is fitted up in an elegant and elaborate manner, and the cabin accommodation is most comfortable. The Norddeutcher Lloyd now own a sufficient number of first-class steamers for a tri-weekly express service between Bremen, Southampton, and New York; and the directors have decided to despatch steamers to New York on Wednesdays, Thursdays, and Sundays from Southampton, after the 7th of March, during the season.

The Steam Haulage of Canal Boats.—At a meeting of the Railway Union in Berlin, Herr Wiebe described some experiments recently made on two lengths of the Oder and Spree Canal, 3½ miles long in all, with a view to ascertain the best method of towing large boats. The submerged chain system is, he states, unsatisfactory, nor has the endless rope system of traction given entirely satisfactory results when practically tested during the course of the experiments, though a great many types of supporting posts and pulleys were tried. The difficulty encountered arose from the rotation of the rope as it moved onward, which tended to twist the boat painter about the rope, and the form of connection between the rope and the painter could not be depended on to stop this action. Further experiments were then made by attaching the rope to the centre of gravity of a heavy towing car, running behind and drawn by a light locomotive such as is commonly used in mines. If the rope is attached directly to the locomotive, trouble may arise from the side pull of the rope tending it to overturn the engine; it is for this reason that the towing car was adopted in the experiments in question. This plan is stated to have proved satisfactory, and boats have been towed by it at the rate of 10 ft. to 12 ft. per second, though a speed of 5 ft. will in general be sufficient. The tension on the tow rope in starting three heavy coal barges was as much as 1,764 lbs., but rapidly decreased as the boats gathered way.

The Manning of the Fleet.—Admiral Sir Edward Fanshawe presided at the Royal United Service Institution, Whitehall Yard, when Captain Charles Johnstone, R.N., read a paper on "Manning the Fleet; a rearrangement of existing corps and their training." The reader stated that his paper was prepared in ignorance of the fact that the Admiralty had summoned a committee to consider matters with which this subject was closely allied. In these circumstances he should have hesitated to offer the suggestions he had set forth had he not been assured that it would be well understood that this was merely an effort to assist in the elucidation of matters which were exercising, if not agitating, the minds of all thinkers on the subject of naval warfare as it interested our country. He entered at length into the changes wrought in the *personnel* of the navy by the rapid disappearance of masts and sails from ships of war. The principal proposals made in the paper were that the number of seamen in the fleet should be reduced to such a complement as would supply jointly all the seamen gunners required and a sufficient number of men for the purely seamen's duties, as boat and anchor work, helm, lead, &c., so that the reduced number might be able to receive a more complete preliminary training than at present; that this body of men should have their first service in sea-going masted ships, and, as far as possible, have a training as seamen of the old sort, and then to be instructed as seamen gunners; that the marines should be increased in number to supply the reduction of seamen, their system of training being modified; and that the whole of the seamen and marines and stokers should be under one organisation so far as discipline was concerned. A discussion followed.

A Large Cargo Steamer.—We are informed that Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne, have received from a Hartlepool shipowning firm an order for a steel steamer of unusually large dimensions. The vessel, which is to be over 400 ft. long and of proportionate width and depth, is to have a deadweight carrying capacity of about 7,000 tons. She will be provided with all the modern appliances for facilitating the loading and discharging of cargo, and will in all respects be fitted up with a regard to thorough efficiency. The contract for the engines, which will be triple-expansion and of exceptionally large power, has been given to the Wallsend Slipway and Engineering Co., Limited.

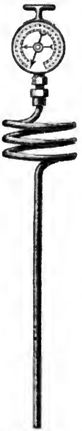
The Serve Ribbed Boiler Tube.—A very large number of orders have been received from engineers and boilermakers at home and abroad for the "Serve Ribbed Boiler Tube," but one order that has recently been cabled from a large firm of shipbuilders in the United States is specially noteworthy owing to the first cost of these tubes being as might be expected in excess of plain tubes—and to the heavy duty—purchasers in America must have considerable faith to make the increased outlay. In another respect the order is noteworthy, in that it is for a large number of "Serve" tubes of 2¼ in. external diameter. At home the tendency is not to decrease the diameter of tubes, as in a boiler recently constructed at Hull 5 in. tubes have been fitted.

Electric Light Fittings.—We have received from the Edison and Swan Electric Light Company, 100, Victoria Street, London, and Ponder's End, a copy of its new catalogue of electric light fittings and instruments. It is divided into three sections, the first being devoted to glow lamps, the second to fittings, and the third to instruments, such as volt meters and resistance coils. The catalogue is fully illustrated, and contains some useful suggestions to those adopting this form of illuminant.

Institution of Engineers and Shipbuilders in Scotland: Graduates' Section.—The usual monthly meeting of the Graduates' Section of this Institution was held last month. Mr. John Sharp, Wh. Sc., President, occupied the chair. The discussion on Mr. Charles Lang's paper on "Modern Workshop Practice" was resumed and concluded. A paper by Mr. John Weir, on "Some Details in Marine Engine Design affecting Efficiency," was then read (in the absence of the author). It led to a long and well sustained discussion, in which the speakers were—the chairman, and Messrs. Ferguson, Welsh, Watson, Borrowman, Wannop, M. T. Brown, William Thomson, and Fraser.

MURRIE'S PATENT PYROMETER.

We herewith illustrate one of these useful instruments, the form shown being specially adapted for marine and locomotive smoke boxes, funnels, &c. They have been largely adopted by eminent firms and experimentalists for over four years past, the users after having them in continuous use for this period testifying to their continued accuracy and value in determining the efficiency of boilers under varying conditions as to fuel and draught.



These instruments are made entirely of steel tube of very fine bore. The extremity of the tube terminates in an expansion chamber which is partially charged with a fluid, the nature of which depends on the particular range of temperature to be registered. The fluid, or rather the tension of the vapour it gives off, actuates the indicator of the pressure dial shown in illustration, this dial being graduated to show the temperature corresponding. One of the many advantages which a pyrometer of this type possesses is that the length of tube does not effect the accuracy of the readings, so that it is possible to obtain the correct temperature say in the centre of a vessel's funnel, even although the intermediate part of the stem be enveloped in gases of a greater or less temperature. It has further this important advantage, that no adjustment is necessary even after long and continuous use. It is made, when desired, not only to indicate the temperature at any given time, but also by auxiliary pointers to register minimum and maximum temperatures over a long period, also by attachment to a self-recording apparatus, to give a permanent continuous record of these variations. The instruments are manufactured and supplied by Messrs. James Murrie & Co., of 9, Granville Street, Charing Cross, Glasgow.

High Speed Atlantic Steamer.—The Fairfield Co. have now practically received the order to build a vessel to their five-day boat design brought out some years ago.

The fastest passage yet made to the Cape has been made by Messrs. Donald Currie & Co.'s *Dunottar Castle*, the net steaming time on the voyage being 16 days 2 hours 31 minutes. This is more than nine hours less than the time taken on the maiden trip of the *Dunottar Castle* to Cape Town, and is said to be thirty-two hours less than the best outward passage of any other of the Cape packets.

The Admiralty have accepted the cruiser *Pearl's* engines from the contractors, Messrs. Earle & Co., and no further tests will be made, the result of the trial being considered highly satisfactory, in view of the modified air pressure used in the stokeholds.

Port Orchard.—Port Orchard, on Puget Sound, is officially recommended as the best site for a proposed dry dock and naval station on the Pacific Coast. The depth of water is 14 fathoms.

H.M.S. "TRIBUNE."

Messrs. J. G. Thomson, Limited, Clydebank, launched on February 21th, the last of the three second-class cruisers they are constructing for the British Government. The first and second of these war vessels, named respectively the *Terpsichore* and *Thetis*, were put into the water by the firm last last year, the former in October and the latter in December. The third, called the *Tribune*, is similar in all respects to the other ships of the same class. Her principal dimensions are—length, 300 ft. 9in.; breadth, 43 ft.; and depth, to upper deck, 22 ft. 9 in.; while the displacement is 3,400 tons, with a mean draught of 16½ ft. Speed being of primary importance in a protected cruiser, the *Tribune* is to have a speed of from 18 to 20 knots. The propelling machinery is to consist of two sets of vertical inverted triple-expansion engines, supplied with steam by five cylindrical steel boilers at 155 lbs. pressure per square inch. In the design of the engines both cast and wrought steel have been largely used, with the view of great strength combined with lightness to the moving parts of the machinery. The two propellers are made of naval brass. The coal supply at the load draught will be 400 tons, enabling the vessel to steam at the ordinary cruising speed of 10 knots for a distance of 8,000 knots without coaling. The vessel is to be rigged with two pole masts carrying light fore-and-aft steadying sails. With regard to the armament of the *Tribune*, the heaviest guns to be carried are two 6-in. quick-firing guns, one mounted on the forecastle and firing forward, and the other on the poop firing aft, both pieces having a very long range. In addition there are to be six 4 7 in. quick-firing 36-pounder guns, three being placed on each broadside, and all capable of firing 12 shots per minute and having a penetrative power equal to 8 in. of iron armour. The auxiliary armament of the vessel will consist of eight quick-firing 6-pounder Hotchkiss guns, one 3-pounder Hotchkiss, and four 5-barrelled Nordenfelt guns, besides four torpedo tubes. The most vulnerable parts of the ship are protected by a steel deck extending the whole length of the vessel and armed transversely, so that it is 4 ft. below the water at the sides. The thickness of this deck on the sloping side amidships is 2 in. and on the flat parts 1 in. The *Tribune*, which has a double bottom and 80 watertight compartments, will be lighted by electricity. The crew is to number 252 men.

OBITUARY.

The funeral of the late Mr. Richard John Napier, surveyor to Lloyd's Register, took place on 12th February, at Leith. The deceased gentleman met his death on the 6th February, by falling into the hold of a vessel at the Northumberland Dock, Newcastle-on-Tyne, while he was engaged in the execution of his duty in making a survey for the load-line. A very large number of gentlemen connected with Lloyd's, and the engineering and shipping industries, attended the funeral, both at Newcastle-on-Tyne and Leith. The deceased gentleman was thirty-two years of age, and was well known in engineering and shipping circles, where he had made many warm friends by his marked ability and uniform courtesy. Mr. Napier had a most distinguished career. He served his apprenticeship with the firm of Messrs. James Bertram & Sons, engineers, Leith Walk Foundry, Leith, and subsequently he was engaged for a number of years as a seagoing engineer, latterly filling the position of chief engineer. He occupied for some time the post of principal assistant in Lockie's Engineering Academy, Leith, and about four years ago he left this situation to become Engineering Surveyor to Lloyd's at Newcastle-on-Tyne. During his apprenticeship he was a student of the Leith Science School, where he carried off the principal prizes, and he also gained a number of Queen's prizes and certificates for mechanical science at the examinations of the Science and Art Department and the City and Guilds of London Institute. He was an earnest student, and had high mechanical and mathematical talents. Before entering Lloyd's he passed with distinction the Board of Trade examination for Extra Chief, which is the highest honour granted by the Board to marine engineers. Mr. Napier has left a widow and two children; and the sad and early death of one who showed such high attainments, and who seemed destined to fill a conspicuous position in the engineering world, will be generally mourned.

Recent applications for Patents connected with Marine Engineering Ship Construction and Mechanical Appliances for use in Ships, from January 16th, to February 16th, 1891.

549 K. D. Noble. Screw propellers.
566 H. Drake. Submarine propellers.
571 T. P. C. Halsey. Jury shafts for propellers.
670 C. Myers and M. Wells. Screw propellers.
698 J. Wadham. Marine propellers.
755. P. Ferguson and W. Y. Fleming. Transmitting motive power for actuating multiple propeller shafts.
784 J. Jameson. Steam engines (C. Tuckfield, Australia).
835 John Dunn and James Dunn. Steam boilers.
990 E. H. Jeeves and H. Gilmore. Steam boiler.
1003 R. G. Ruffles. Steam boilers.
1021 H. Montgomerie. Piston and slide rods.
1045 W. Brown and C. Neale May. Steam-engines.
1052 P. E. J. Niclausse and G. A. L. Niclausse. Multitubulous boilers.
1125 E. Coverly and S. E. Carlisle. Boiler furnaces.
1159 G. A. Newatt. Steam boiler.
1212 R. Holdsworth. Method of correcting the course of a vessel, for variation, deviation, and the like.
1389 J. Douglas. Valves and valve gear.
1436 D. A. Frarer and J. W. Cosford. Steam-engines.
1437 S. Wilcox. Compound steam-engines.
1549 J. MacHaffie. Propellers.
1570 W. Worsdell and R. J. Threlfall. Balanced slide valves.
1581 R. Haddon. Apparatus for stopping engines (E. Passburg, Germany).
1629 W. R. Earp. Boiler anti-incrustation compounds.
1653 R. Robson. Boilers.
1735 B. M. Fletcher. Governing steam-engines.
1744 H. H. Lake Steam boilers (J. Lorillard, U.S.).
1805 T. G. Lishman. Steam boiler furnaces.
1838 R. McGlasson. Screw propellers.
1986 B. F. Sparr and M. F. Sparr. Screw propellers.
2023 T. Lumb and F. Harrison. Means for the removal of condensed steam from cylinders.
2146 H. H. Lake. Boiler furnaces (W. F. Hawley and S. N. Sapp, U.S.A.).
2166 E. Wigzell and J. Pollit. Boiler feed pump for steam engines.
2167 A. Laidler and J. Thompson. Adjustable pitch reversing propeller.
2228 A. Vogelsang. Propulsion of ships.
2264 R. Chambers. Boiler furnaces.
2295 G. M. Dèmoulin. Valves and valve gear.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

January 24th, 1891,	Brackenbury, Wm. P. ..	Ex 1C	Hull
,, ,, ,,	Brown, Jno. N.	Ex 1C	Leith
,, ,, ,,	Craigie, Alex.	Ex 1C	,,
,, ,, ,,	Hastwell, Henry........	Ex 1C	N. Shields
,, ,, ,,	Hoy, G. P.	Ex 1C	Dundee
,, ,, ,,	McEwan, Jno.	Ex 1C	Leith.
,, ,, ,,	Scott, Wm.	Ex 1C	,,
,, ,, ,,	Wake, Tom	Ex 1C	W.Hartlpl

Note.—1 C denotes First Class; 2 C, Second Class.

January 24th, 1891.

Archer, Frank D.	2C	Dundee
Bell, Joseph ..	2C	N.Shields
Brown, Francis	2C	Glasgow
Brown, Walter..	2C	Dundee
Crew, John B...	1C	London
Cumming, J.C.M	1C	Glasgow
Dodds, Thos. ..	2C	N.Shields
Emery, Henry R.	2C	L'pool
Fawns, James..	2C	London
Firth, Jno. Wm.	1C	,,
Gardner, W.M.	1C	N.Shields
Hampton, P. G.	1C	Glasgow
Harvey, Peter..	1C	N.Shields
Henderson, Wm.	1C	London
Hood, John	1C	Glasgow
Hughes, J. E. D.	2C	L'pool
Johnson, Thos.	2C	London
McAdam, Jno.	2C	Glasgow
McClymon, Qn.	1C	,,
McColl, Wm. ..	1C	,,
McDonald, Jas.	2C	London
McKay, Jno. R.	2C	Glasgow
Maddox, Jsph.K.	2C	L'pool
Martin, Peter ..	2C	Dundee
Paton, James ..	2C	Glasgow
Penfold. Daniel	2C	London
Ponder, Thos. J.	2C	N.Shields
Renant. Fred. W.	2C	London
Rutherford, T.W	1C	N.Shields
Stranack, R. S.	2C	London
Temperton, F.W	1C	,,
Turner, Chas.Js.	2C	,,
Tyser, Charles	2C	,,
Wase, Robt.....	2C	N.Shields
Willett, Lancelot	1C	L'pool
Wilson, Andw.L.	1C	Dundee
Wilson, Daniel	2C	London

January 31st, 1891.

Anderson, Wm.	1C	N.Shields
Bell, William ...	2C	,,
Blakey, William	2C	Sndrland
Bradley, George	2C	N.Shields
Britton, Foster	1C	Hull
Carr, Harry ..	1C	Sndrland
Caie, Alex. ..	1C	Aberdeen
Cheal, Joseph ..	2C	Cardiff
Christian, Chas.	2C	L'pool
Cockburn, Jno.	1C	N.Shields
Downie, Wm. ..	2C	London
Fairbrother, J.W.	2C	L'pool
Gill, James S...	1C	Sndrland
Glover, Alex. G.	2C	Sthmptn
Hare, Fred. H.	2C	N.Shields
Hire, George A.	2C	Cardiff
Kilgour, Lewis	2C	N.Shields
Luke, Richard..	1C	L'pool
McKay, R. L. G.	1C	Aberdeen
Masson, Wm. M.	2C	Sndrland
Menzies, Geo. ..	2C	,,
Murphy, James	2C	L'pool
Ness, George ..	2C	Aberdeen
Neville, Fredk.	2C	L'pool
Otken, Wm. ..	2C	Sthmptn
Parker, W. R...	2C	N.Shields
Redfern, H. ..	2C	Sndrland
Ridehalgh, W. H.	2C	Hull
Roberts, Edwrd.	1C	L'vpool
Robson, Thomas	2C	Sndrland
Rutherford, W.A	2C	Aberdeen
Ryberg, Anders	2C	Sthmptn
Sinclair, Thos.O.	1C	Sndrland
Smith, George..	2C	N.Shields
Straughan, J.W.	2C	,,
Sturdy, Frank..	1C	Hull
Taylor, David R.	1C	L'pool
Taylor, Robt. F.	2C	Cardiff
Thomson Geo...	1C	Aberdeen
Watson, William	2C	Sndrland
Will John ..	2C	Aberdeen
Williams, David	1C	Cardiff

February 7th, 1891.

Baty, Geo. R. ..	2C	N.Shields
Craggs, Chas. E.	1C	,,
Davidson, James	2C	Glasgow
Edwards, David	2C	,,
Grass, William	2C	,,
Gray, Wm. ..	2C	,,
Griffith, Richard	1C	L'pool
Hamilton, A. W.	2C	Glasgow
Hayes, Robt. W.	2C	N.Shields
Hogg, James ..	2C	,,
Inglis, Wm. ..	1C	Glasgow
Irving, William	1C	,,
Jackson, Wm...	2C	N.Shields
Johnson, Wm...	2C	,,
Jones, Thos. C.	1C	Glasgow
McAndrew, Jas.	2C	L'pool
McKillop, Robt.	2C	Glasgow
Menzies, James	2C	,,
Muir, Alex. H.	1C	Glasgow
Orme, J. T. H.	2C	London
Orr, Wm. Jno.	2C	,,
Pott, B. W. ..	2C	,,
Rutherford, J...	1C	Glasgow
Saunders, S. H.	1C	London
Scott, Henry J.	1C	N.Shields
Scott, Jno. Wm.	2C	,,
Setford, Harry..	2C	L'pool
Shaw Robt. J...	1C	N.Shields
Sinclair, Alex...	2C	Glasgow
Sloan, James ..	2C	,,
Small, Jno. B...	1C	,,
Sommerville, J.	1C	,,
Terner, Charles	2C	N.Shields
Thomson, Robt.	2C	London
Vattier, K. C. G.	1C	,,
Watson, Andrew	2C	L'pool
Williamson, J...	2C	Glasgow

February 14th, 1891.

Arrowsmith, J.M.	2C	L'pool
Atcheson, Wm.	1C	Hull
Bain, George W.	2C	L'pool
Beatson, David	1C	Greenock
Bell, William A.	1C	Leith
Bulman, H. Jas.	2C	,,
Butcher, Frank	2C	Plymo'th
Colquhoun, W.H.	2C	Greenock
Don, John	2C	London
Frier, W. Jas...	1C	N.Shields
Gerard, Thomas	1C	Greenock
Griffith, L. T. ..	1C	Leith
Hamilton, A. H.	2C	Greenock
Kerr, William ..	2C	,,
Kinghorn, W.A.	2C	Leith
Knowles, Geo...	2C	Greenock
Lawson, Wm. ..	1C	Leith
McGown, Albert	2C	L'pool
McKintosh, W.	1C	Leith
McLennan, Alex.	1C	Greenock
Mallett, Thos....	2C	N.Shields
Melville, John...	1C	Leith
Moffat, George	2C	,,
Moyes, Andrew	2C	,,
Nicoll, David M.	2C	,,
Pappa, John G.	2C	Liverpool
Parsons, Thos. G.	1C	Leith
Riel, Thomas ...	2C	N.Shields
Ritson, Stan. M.	2C	,,
Robertson, J. ...	1C	Greenock
Scarfe, James H.	2C	N.Shields
Seaton, James..	2C	Greenock
Shores, Josh. W.	1C	Hull
Stark, James ..	1C	Leith
Stevenson, John	2C	Hull
Stewart, F. R...	2C	Greenock
Tait, Wm. S. ..	2C	,,
Thom, David ..	1C	Leith
Thorp, Richard	2C	Hull
Tinn, John Geo.	2C	N.Shields
Turnbull, Wm.	1C	,,
Turner, Fred. G.	2C	Hull
Vipond, Alf. C.	2C	Leith
Webster, John B.	2C	Greenock
Welch, Ernest R.	2C	London

H.M.S. "Pearl."—This ship, which has been built at Pembroke dockyard and supplied with machinery by Earle's Shipbuilding and Engineering Co., Limited, Hull, has now undergone her natural and forced draught trials in the Bristol Channel with most satisfactory results. In the former case the run was of eight hours' duration, and the mean power 5,363 I.H.P., with a speed of 18·43 knots. On the forced draught trial on February 20th the air-pressure in the stokeholds was limited to 1¼ in., instead of the 2 in. allowed by contract, on a four hours' run, when the mean power developed was 7·135 I.H.P. at 158 revolutions, with a speed of 19¼ knots. The highest power attained on this trial was 8,000 H.P.

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